CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

JULY 15, 1945

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES

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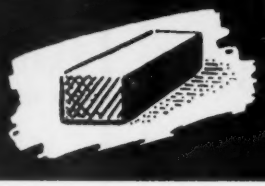
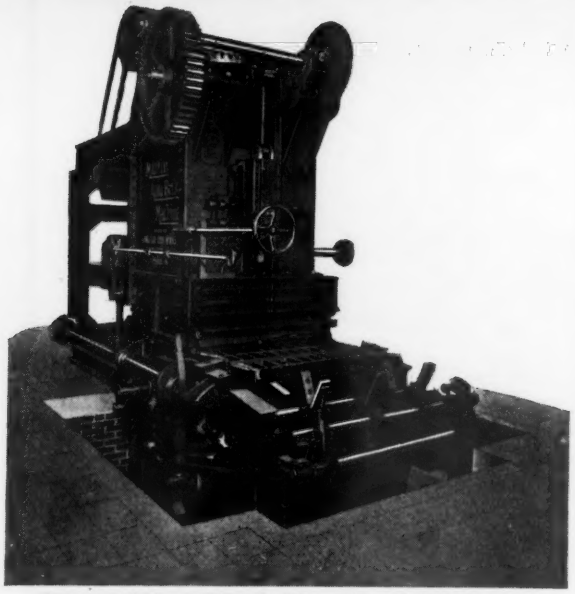
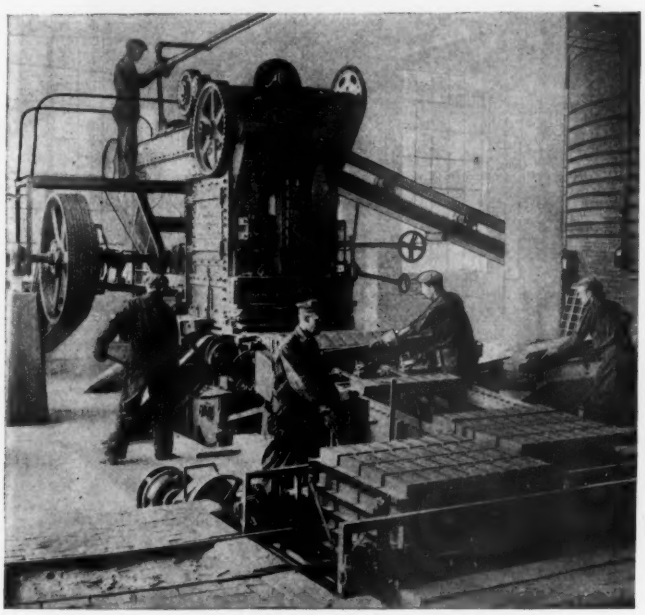
FOR AUTOMATIC MANUFACTURE  OF GENUINE SAND MOLDED BRICK



Model 46 "Martin" Vertical Type "Autobrik" Machine



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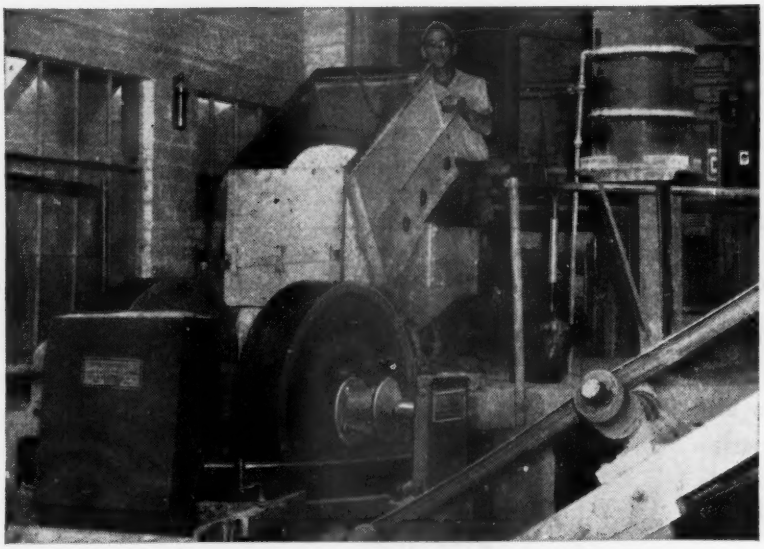

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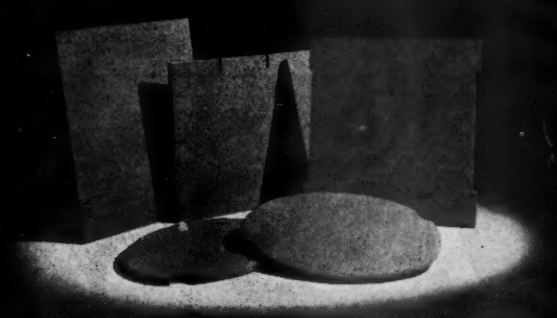

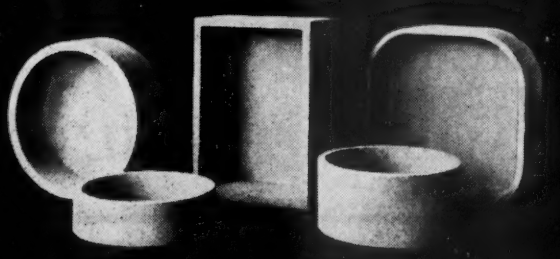

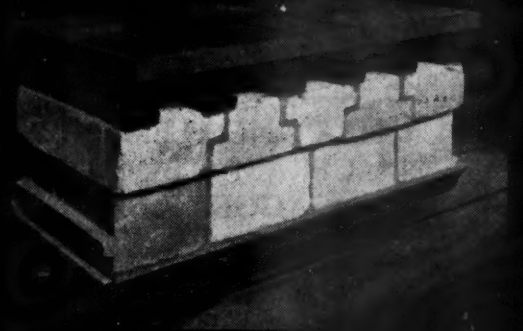

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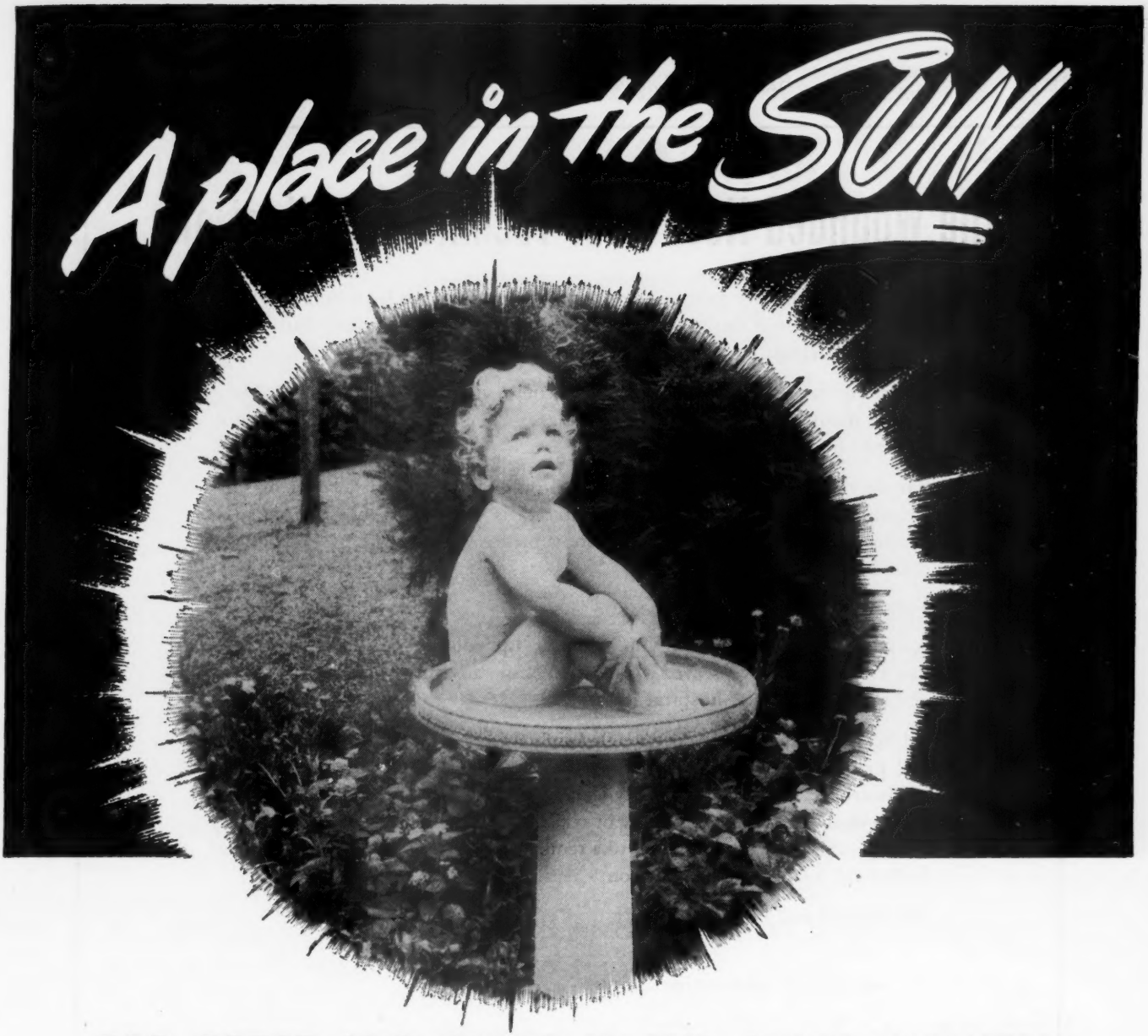

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The following is the operating data for both campaigns. We believe you will agree that the increased production figures fully justify the description above—"*Progress* with Corhart."

	8/14/39 to 1/8/42	3/5/42 to 1/19/45	Percent of Increase
Melting Area	770.5	770.5	0.0%
Total Days Life	870	1,051	20.8%
Total Operating Days	803	1,018	26.8%
Total Tons Glass Produced	75,631	102,899	36.0%
Tons Glass Per Day (Life)	87	98	12.6%
Tons Glass Per Day (Operating)	94	101	7.4%
Tons Glass Per Sq. Ft. Per Life	98.15	133.54	36.0%

On the third Corhart rebuild of this tank, now completed, the use of improved Corhart Electrocast products was extended. Further progress is expected. Corhart Refractories Company, *Incorporated,* 16th and Lee Streets, Louisville 10, Kentucky.

*Not a product, but a registered trade-mark.

CORHART
ELECTROCAST
REFRACTORIES

Ceramic Abstracts Section

Compiled by

THE AMERICAN CERAMIC SOCIETY

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 24 **July 15, 1945** **No. 7**

Abrasives

Centerless grinding of glass parts. ANON. *Engineering*, **159** [4136] 316 (1945).—A new technique has been developed for the grinding of glass parts, employing the centerless grinding machine so widely used for metal parts. The machine has a capacity for parts up to 1.5 in. in diameter by 18 in. long in the case of tubular glass. Glass tubes $^{13}/_{16}$ in. in diameter by 3.5 in. long can be ground externally in two or three passes at a rate of 200 per hr. to limits of ±0.00025 in. for size and 0.0002 in. for concentricity. For grinding tapered plugs, cocks, stoppers, etc., the plunge-grinding method is adopted. G.A.K.

Hydroelectric development in Britain: II. ALEXANDER GIBB. *Chem. Age* [London], **51** [1324] 467–69 (1944).—Speaking generally, hydroelectric power cannot be produced in Britain at a figure that compares favorably with that in Canada, the U. S., or Norway. Industries in which the cost of power is a high proportion of production costs must therefore be ruled out, except on grounds of national security. For example, in the manufacture of silicon carbide with electrical energy at a farthing a unit, the cost of power is about 60% of the prewar selling price of the American product. On a similar basis the cost of power in the manufacture of fused alumina is 26% of the prewar selling price, and the cost of calcium carbide is 15%. If, in Britain, electric power is going to cost 0.75d. a unit, as may well be the case, these percentages are increased threefold, and production at competitive prices of the raw materials becomes impossible. Calcium carbide has become a raw material of fundamental importance to industry, especially to the chemical industry. The present output in Britain is likely to be required for acetylene for welding purposes alone, but acetylene is a starting point in the synthesis of a large number of highly important organic chemicals, including substances vital not only to the chemical industry itself but to allied industries dependent upon it, such as the plastic industry. One-fifteenth part of the entire German chemical industry was devoted to the manufacture of carbide. The necessary raw materials, coke and lime, are available in abundance in Britain, and the development of the calcium carbide industry in Scotland and South Wales is not only desirable but inevitable. A.B.S.

Influence of vibration on life of hardness indenters. W. DAWIHL AND W. RIX. *Werkstattstech. u. Werksleiter*, **37**, 34–35 (1943); abstracted in *Ind. Diamond Rev.*, **5** [53] 75 (1945).—Very fine vibrations, e.g., of buildings, tend to shorten the life of diamond hardness indenters considerably, as shown by experiments made by the authors. These vibrations were avoided by placing the testing machine on spring-cushioned supports. Possibly the vibration dampers are advantageous not only from the economic but also from the technical point of view. 1 reference. P.G.

Polishing jacks can be converted to efficient belt grinders. RUPERT LE GRAND. *Amer. Machinist*, **89** [11] 103–105 (1945).—In many cases a conversion from a grinding wheel or polishing jack to a belt grinder brings about advantages resulting in higher production and better finish. The pieces can be pressed against the contact wheel, on the unsupported portion of the belt between pulleys, or on a section of the belt supported by a platen or table, but this is done usually on bench-type equipment. Contact-wheel diameters of 12 to 14 in. and belt lengths of 132, 138, 148, and 168 in. are used for polishing-jack conversions, and diameters of 6 to 8 in. and lengths of 48 and 60 in. are used for bench-grinder conversions. Belt widths range from 2 to 4 in. M.HA.

[Special truing devices.] ANON. *Ind. Diamond Rev.*, **5** [53] 78–82, 84, 87–88 (1945).—Commercially available truing devices are reviewed, with descriptions of methods and devices. For the production of spline gauges, small broaches, and splined components, an attachment was designed by the Monarch Tool Co., Ltd., for the use of which only a standard surface grinder is needed. A profile and radius truing device using the principle of template copying is manufactured by Best Tools Corp. A radius truing device produced by R. G. Boardman & Co., another Radiform forming attachment by W. F. Meyers Co., Inc., a center-hole grinder by A. Herbert, Ltd., and a new truing device by J. & S. Tool Co. are described in detail. Mention is made of a crushing method on Pulcrush equipment designed by the Churchill Machine Tool Co., Ltd. 6 references, 18 illustrations. P.G.

Thief for hard granular material. C. F. BOOTH. *Ind.*

Eng. Chem., Anal. Ed., **17** [4] 272 (1945).—B. gives details of construction and usage for a thief which has been used successfully in sampling aluminous abrasives. 3 figures. F.G.H.

Truing tools with steel disks. ANON. *Werkstattstech.*, **35**, 418–19 (1941); *Werkstattstech./Der Betrieb*, **37/22**, 184 (1943); abstracted in *Ind. Diamond Rev.*, **5** [53] 85–86 (1945).—Steel disk truing tools manufactured by R. Ribcke & Co. are described; all parts are interchangeable within gauge limits, and the truing wheels can easily be exchanged. The setting is discussed, and diagrams are reproduced of two new truing devices, one containing two bearings, produced by Guilleaume Werke, and the other with a single bearing, produced by Indeg Industrie Diamanten Imp. Ges. Hints are given on the handling of truing tools. 1 reference, 8 figures. P.G.

PATENTS

Abrading wheel dressing means. A. G. CHRISTEL AND KARL FUCHS. U. S. 2,376,959, May 29, 1945 (April 14, 1944). 2 claims. (Cl. 125-11).

Abrasive drilling machines. PHILIPS LAMPS, LTD., A. C. VAN DEN BERG, AND H. KENYON. Brit. 568,524, April 18, 1945 (Sept. 29, 1943).

Apparatus for grinding and buffing metallic articles, etc. F. C. GLIKE (International Silver Co.). U. S. 2,376,847, May 22, 1945 (Nov. 18, 1942). 10 claims. (Cl. 51-145).

Coated abrasive. N. E. OGLESBY (Behr-Manning Corp.). U. S. 2,375,814, May 15, 1945 (Oct. 6, 1942). 8 claims. (Cl. 51-301).

Coating material. L. H. METZGER (Industrial Abrasives, Inc.). U. S. 2,376,163, May 15, 1945 (Aug. 12, 1940). 5 claims. (Cl. 106-82).—1. As a new composition of matter, a hard bonding heat-resisting material comprising a mixture of a comparatively large amount of high ratio potassium silicate solution embodying more than 2 parts silica to 1 part potassium oxide and a smaller amount of low ratio potassium silicate solution embodying no more than 2 parts of silica to 1 part of potassium oxide, an admixture of no more than one-third the amount by weight of aluminum silicate, and an extremely small quantity of a wetting agent.

Control mechanism for honing machines. H. J. CALDWELL AND E. Y. SEBORG (Barnes Drill Co.). U. S. 2,377,310, June 5, 1945 (Nov. 14, 1942). 19 claims. (Cl. 51-34).

Gear-lapping machine. O. C. KAVLE (Kavle-Head Corp.). U. S. 2,377,241, May 29, 1945 (July 14, 1942). 5 claims. (Cl. 51-94).

Grinding machine. JACOB DECKER AND B. A. KEARNS (Cincinnati Milling Machine Co.). U. S. 2,376,236, May 15, 1945 (Dec. 19, 1942). 25 claims. (Cl. 51-95). JACOB DECKER AND A. D. C. STUCKEY (Cincinnati Milling Machine Co.). U. S. 2,376,237, May 15, 1945 (Dec. 26, 1942). 16 claims. (Cl. 51-165).

Grinding, slitting, and cutting-off machine. W. ASQUITH, LTD., AND A. JOHNSON. Brit. 568,639, April 25, 1945 (Aug. 24, 1943).

Grinding wheel dressing device. G. W. STARN. U. S. 2,377,822, June 5, 1945 (Feb. 28, 1944). 1 claim. (Cl. 125-11).

Honing device. JOSEPH SUNNEN. U. S. 2,376,851, May 22, 1945 (Aug. 16, 1943). 12 claims. (Cl. 51-184.3).

Honing machine. E. Y. SEBORG (Barnes Drill Co.). U. S. 2,377,272, May 29, 1945 (Sept. 13, 1943). 10 claims. (Cl. 51-34). JOSEPH SUNNEN. U. S. 2,377,588, June 5, 1945 (Jan. 21, 1942). 15 claims. (Cl. 51-184.3).

Lapping machine. W. F. EGGER (A. P. Schraner, doing business as A. P. Schraner & Co.). U. S. 2,376,531, May 22, 1945 (Nov. 11, 1943). 12 claims. (Cl. 51-73.1).

Machine for grinding knife blades. C. F. BROWN. U. S. 2,377,126, May 29, 1945 (Oct. 20, 1943). 7 claims. (Cl. 51-48).

Machines for grinding twist drills. K. TRIPPEL. Brit. 568,414, April 18, 1945 (June 8, 1943).

Making coated abrasives. N. E. OGLESBY (Behr-Manning Corp.). U. S. 2,375,813, May 15, 1945 (June 9, 1941). 11 claims. (Cl. 51-295).

Manufacture of abrasives. R. P. CARLTON (Minnesota Mining & Mfg. Co.). U. S. 2,376,342, May 22, 1945 (Jan. 20, 1930; July 8, 1941). 6 claims. (Cl. 117-17). U. S. 2,376,343, May 22, 1945 (July 28, 1942). 6 claims. (Cl. 117-17).

Art and Archeology

Advisory committee system in relation to stained glass. F. C. EELES. *Jour. Brit. Soc. Master Glass-Painters*, **9** [2] 63–67 (1943–1944); abstracted in *Jour. Soc. Glass Tech.*, **28** [127] 102 (1944).—E. traces the development of the Central Council for the Care of Churches and Advisory Committees (statutory bodies since 1798). In connection with stained glass, the Committees were faced with several long-standing difficulties. One was the development in Victorian times of an unworthy type of glass that kept out light or had crude coloring, with bad drawing and the constant repetition of the same design or part of a design. Glass of very original type that might be most desirable in a modern church, or even in many Victorian ones, was often out of place in an ancient building. Another important task of the Advisory Committees concerned the preservation of ancient glass. An immense amount of the most careful repair and releading of ancient glass was done between the two great wars. There were many cases where ancient glass, formerly in private hands, had been secured and placed in churches. Two illustrations are given of 15-century glass placed, in 1930–1931, in Wixford church, Warwickshire.

Ancient glass in Nottinghamshire—a survey: I. NEVIL TRUMAN. *Jour. Brit. Soc. Master Glass-Painters*, **9** [2] 51–60 (1943–1944); abstracted in *Jour. Soc. Glass Tech.*, **28** [127] 102 (1944).—T. claims to give the first detailed survey of ancient stained glass in Nottinghamshire. He describes (with 5 illustrations) glass at Annesley, Attenborough, Averham, Balderton, Barton, Beauvale Priory, Beeston, East Bridgford, Carlton in Lindrick, and Cossall. The complete survey covered about fifty places.

Armorial glass of the enamel period at Stoke Poges. E. A. GREENING LAMBORN. *Jour. Brit. Soc. Master Glass-Painters*, **9** [2] 32–43 (1943–1944); abstracted in *Jour. Soc. Glass Tech.*, **28** [127] 102 (1944).—An account of the heraldic shields in the manor house and parish church of Stoke Poges, with particulars of the various families concerned, is given. A folding "Key Pedigree showing the connections of Sir Edward Coke with the families of Manners, Fortescue, and Greville" is included. 4 illustrations.

Cone 015 relief enamels for decorating vitreous china. JOHN H. VOORHIES. *Jour. Amer. Ceram. Soc.*, **28** [6] 170–71 (1945).—3 references.

List of works by Bernard Rackham relating to stained and painted glass. ANON. *Jour. Brit. Soc. Master Glass-Painters*, **9** [2] 61–62 (1943–1944); abstracted in *Jour. Soc. Glass Tech.*, **28** [127] 102 (1944).—One book and numerous articles and reviews in periodicals are included.

Method for the creation of geometric designs based on structure. EDWIN M. BLAKE. *Jour. Amer. Ceram. Soc.*, **28** [6] 156–67 (1945).—29 figures.

PATENTS

Designs for:

Condiment shaker, etc. R. V. GANZ (Shawnee Pottery Co.). U. S. 141,323, May 22, 1945 (Feb. 28, 1945). (Cl. D44-22). U. S. 141,325, May 22, 1945 (March 1, 1945). (Cl. D44-22). U. S. 141,339, May 22, 1945 (March 2, 1945). (Cl. D44-22).

Cooky jar. R. V. GANZ (Shawnee Pottery Co.). U. S. 141,322, May 22, 1945 (Feb. 28, 1945). (Cl. D58-25).

Glass bonbon dish, etc. C. L. FORDYCE (Pitman-Dreitzer & Co., Inc.). U. S. 141,517, June 5, 1945 (Feb. 2, 1945). (Cl. D36-2).

Plate. M. C. RUSKIN. U. S. 141,314, May 22, 1945 (June 1, 1944). (Cl. D44-15). U. S. 141,459, June 5, 1945 (June 1, 1944). (Cl. D44-15).

Teapot. R. V. GANZ (Shawnee Pottery Co.). U. S. 141,324, May 22, 1945 (Feb. 28, 1945). (Cl. D44-26).

Cements

Cement from gypsum. P. PARRISH. *Chem. Age* [London], **52** [1333] 41–44 (1945).—Both cement and sulfuric acid are manufactured from gypsum by adding one-thirtieth of its weight of finely ground coke and a suitable proportion of clay and shale. All the minerals must be dry and finely ground. The calcining must be done under slightly oxidizing conditions to prevent the formation of oxysulfides and a fused mass instead of a clinker. The clinker is ground to form cement, and the gases are passed through a contact chamber to oxidize the sulfur dioxide and produce a sulfuric acid. A.B.S.

Effect of lime on dehydrated kaolin and on natural pozzuolanas. GIOVANNI MALQUORI AND VITTORIO CIRILLI. *Ricerca Sci.*, **14,** 85–93 (1943); abstracted in *Chem. Zentr.*, **1944, I** [7/8] 413–14.—After about 3 months in contact with saturated milk of lime, dehydrated kaolin can absorb at ordinary temperature an amount of CaO that corresponds to the saturation limit given by Rebuffat and Strötling. Small leaves of hexagonal section are formed similar to the crystals of the Ca aluminate hydrates but with somewhat lower refractive index. At somewhat higher temperature and higher CaO content of the solution, cubic crystals of $3CaO \cdot Al_2O_3 \cdot 6H_2O$ are formed. Roentgen spectra show, besides the lines of the system SiO_2–CaO–H_2O with $CaO : SiO_2 = 1$ to 1.5, some new characteristic lines which seem to correspond to the compound $2CaO \cdot SiO_2 \cdot Al_2O_3$ aq. The action of milk of lime on natural leucitic and alkali trachytic pozzuolanas leads, even after years of contact, only to compounds of the system SiO_2–CaO–H_2O, which under the microscope show thin laminas of hexagonal section similar to those of Ca aluminate hydrates. M.HA.

Investigations of the mechanical properties of mortars and concretes on the basis of hydrocarbon binders and comparison with mortars and concretes on the basis of hydraulic binders. M. DURIEZ. *Inst. tech. Batiment Trav. Publics Circ.*, Ser. H, **1943,** No. 9, 28 pp.; abstracted in *Chem. Zentr.*, **1944, I** [9/10] 579.—Comparisons are made between organic colloidal binders (tar and bitumen) mixed with fillers (sand and gravel) and hydraulic binders. The importance of proper proportioning of organic binders is emphasized, and aging phenomena are discussed briefly. M.HA.

Maine cement plant combines two kilns. ANON. *Concrete, Cement Mill Ed.*, **53,** 110–11 (1945).—Two 11- x 200-ft. kilns were combined to give one kiln 11 x 356 ft. The firebrick lining was kept in place. An elaborate system of heat recuperating chain loops will save coal. Slower reaction time will give a higher quality cement. An inclined-grate cooler is provided for the clinker. W.D.F.

Mortars for use with concrete brick. ANON. A note published in but not included as a formal part of British Standard Specification 1180—1944.—Mortars of all types may be used for concrete brick, but strong cement mortars should not be used for brick of high drying shrinkage. The materials used should conform to the corresponding Specifications, viz., cement, B.S. 12, 146, or 915; lime, B.S. 890 (*Ceram. Abs.*, **19** [9] 209 (1940); **20** [2] 39 (1941); **21** [3] 62 (1942)). Cement mortar should be composed of Portland cement, Portland blast-furnace cement, or high-alumina cement and clean siliceous sand in the proportions of 1 volume of cement to not less than 2 or more than 4 volumes of sand. Cement-lime mortar should be composed of Portland cement, Portland blast-furnace cement, dry hydrated building lime or properly slaked lime putty, and clean siliceous sand. Eminently hydraulic magnesian lines or dolomitic limes should not generally be used in cement-gauged mortars. The proportions should be within the following ranges:

Cement	Lime	Sand
1	1	6
1	2	6–9
1	3	8–12

Nonhydraulic or semihydraulic lime mortars should be composed of 1 volume of sound slaked or dry hydrated lime to not less than 2 or more than 4 volumes of sand. Dry hydrated lime should be converted into putty and allowed to mature for some hours before use, or the mortar should be allowed to mature in a moist atmosphere before use. Eminently hydraulic lime mortar should be composed of clean siliceous sand and either sound dry hydraulic lime or hydraulic lime slaked on the site by skilled men. The mortar should be composed of 1 volume of the lime and not less than 2 or more than 3 volumes of sand. The sand should contain less than 5% of material separable by washing through a 200-mesh B.S. sieve. It should not contain appreciable amounts of organic matter or soluble salts. A.B.S.

Open letter addressed to operators of rotary limekilns. W. R. CLIFFE. *Pit and Quarry*, **37** [11] 102–104, 106 (1945).—C. discusses rotary limekiln practice, touching upon the following phases of the subject: heat problems, fuel consumption, kiln feed, draft, preheaters, kiln speed, and insulation. 1 photograph. M.R.

Enamel

Application of enamels to the new steels. G. H. MCINTYRE. *Finish*, **2** [3] 37, 48, 52 (1945).—In stressing the importance of enamel-shop operators in developing the one-coat white enamels, McI. describes new requirements for pickling, application and firing methods, and enameling over welds. W.R.B.

Descaling of steel by pickling in acids. W. O. KROENIG AND E. M. SARETZKY. *Korrosion u. Metallschutz*, **17,** 243–46 (July, 1941); abstracted in *Jour. Iron & Steel Inst.* [London], **146** [2] 176A (1942).—To prove that pickling is an electrochemical process, the authors studied the behavior of steel [10% H_2SO_4] oxidized-steel electric cell. The investigation led to the following conclusions regarding the phenomena involved in the pickling process: (1) Pickling is based on an electrochemical dissolution of steel and a reduction of the higher oxides to ferrous oxide by the hydrogen liberated. Ferrous oxide is dissolved by the acid and thus causes the scale to break off from its base. (2) It is mainly Fe_3O_4 which is reduced and which is effective as a depolarizer. Practically no Fe_2O_3 is reduced. (3) Unless there is some contact between the electrolyte and the metal surface covered by the scale, no hydrogen will be liberated at the cathode, no gaseous hydrogen being given off at the scale. (4) The liberation of hydrogen at the anode is due to local cells. (5) The rate of descaling is mainly controlled by the cathode potential. (6) After the reduction of Fe_3O_4, the current intensity of the steel [acid] scale cell decreases considerably. (7) The following three-electrode cell is effective in the pickling process: Fe (cathode areas)-Fe (anodic areas)-scale. (8) The loss in weight of the anode due to contact with a scale layer of the same area is less than 10% of the total quantity of dissolved anode metal.

Future bright for West Coast enameling. G. C. CLOSE. *Finish*, **2** [4] 17, 50–51 (1945). W.R.B.

Home appliance picture in postwar Britain. ERNEST A. DENCH. *Finish*, **2** [4] 13–15, 50 (1945).—3 illustrations. W.R.B.

Metal cleaning: I, Indirect performance tests. JAY C. HARRIS. *ASTM Bull.*, No. 133, pp. 23–28 (March, 1945).—Cleaning processes may be classified as (1) soak tank, (2) mechanical tank or spray, (3) electrolytic, (4) solvent or vapor degreasing, and (5) emulsion degreasing. Available analytical methods and specifications are outlined. Performance tests considered (and their general applicability) are (1) pH and titration values, (2) colloidal properties, (3) water softening, (4) conductivity, (5) solvent action, (6) surface and interfacial tension, (7) emulsification, (8) rinsability, and (9) stability under conditions of usage. B.C.R.

Porcelain table tops. JAY GARY. *Finish*, **2** [4] 20, 54 (1945).—Porcelain enameled table tops will continue to lose favor unless they are placed on tables of good design. G. suggests that the porcelain enamel industry offer $5000 in prizes for the best designs of breakfast sets. W.R.B.

Recent acid- and alkali-resistant enamels. EUGENIO ROMANONI. *Emailwaren-Ind.*, **20,** 75–81 (1943); abstracted in *Chem. Zentr.*, **1944, I** [9/10] 579.—Experiences in Holland, Germany, and Belgium and results of R.'s experiments are reported. Both the acid- and the alkali-resistant enamels should still be much improved. M.HA.

Spotlight turns on kitchens. MARGARET DAVIDSON. *Finish*, **2** [3] 11–13 (1945).—Postwar kitchens are previewed. 5 illustrations. W.R.B.

State of diffusion of hydrogen in pure iron at room temperature. G. CHAUDRON AND L. MOREAU. *Compt. Rend.*, **213,** 790–92 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I,** Dec., 525.—Absorption of H in Fe by electrolysis may be a surface effect, as evidenced by superficial change of hardness (in this case the H can be expelled by electronic bombardment), or it may be an intergranular effect causing brittleness, which disappears when the H is removed in vacuum. A minute proportion of H enters the Fe lattice and can be removed by electronic bombardment. Experimental data are tabulated.

Suggested layout for a continuous-furnace refrigerator-liner plant. A. B. KIMPEL. *Finish*, **2** [3] 25–28 (1945).—Illustrated. W.R.B.

Suggested layout for a continuous-furnace stove and table-top plant. M. M. MURPHY. *Finish*, **2** [4] 27–30 (1945).—Illustrated. W.R.B.

Suggestion for relief from scumming in antimony-free enamels. A. LANDER AND L. LODESTRO. *Finish*, **2** [3] 17, 50 (1945).—Zinc oxide has been found helpful in eliminating scumming in antimony-free enamels. W.R.B.

PATENTS

Enamel-coated article. MORRIS BROWN AND R. E. HARR (Western Electric Co., Inc.). U. S. 2,377,321, June 5, 1945 (May 20, 1939). 6 claims. (Cl. 204-38).—4. A method of forming an enamel-coated article which comprises copperplating a ferrous metal base, electrodepositing an alloy of 0.50 to 10.0% iron and the remainder nickel on the copperplate, and applying a vitreous enamel coating over the alloy plate.

Glass

[**Abrasives for optical glass.**] ALBERT G. INGALLS. *Sci. Amer.*, **172,** 319–20 (1945).—Cerium oxide is strongly competing with rouge for optical polishing. It is cleaner and faster and allows more accurate work. Commercial ceria should be dispersed in a wetting-agent solution and levigated before being used. Barnesite is even better than ceria, although more expensive. Garnet fines are rapidly being substituted for fine emeries as a finished abrasive for grinding. W.D.F.

All-glass chemical plant. B. H. TURPIN. *Ind. Chemist*, **20,** 185–94 (April, 1944); abstracted in *Jour. Soc. Glass Tech.*, **28** [129] 137 (1944).—Descriptions are given of the use of glass on a large scale as stills, condensers, scrubbing towers, etc. The advantages of glass for plant work are (1) permanent resistance to corrosion, (2) purity of product, (3) visability of contents, (4) interchangeability of units, and (5) light weight. 12 illustrations.

Analysis of quartz glass. V. WARTENBERG. *Naturwissenschaften*, **30,** 440 (1942); *Brit. Chem. Phys. Abs.–B*, **1943, I,** April, 158.—Two samples of transparent quartz glass contained 0.020 and 0.027% Al_2O_3 and 0.011 and 0.010% of $Na_2O + K_2O$, respectively.

Application of phase-contrast microscopy to model experiments on polishing of glasses. W. LOOS, W. KLEMM, AND A. SMEKAL. *Naturwissenschaften*, **29,** 769–70 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I,** Nov., 465.—The phase-contrast method is of use in the examination of glass surfaces for perfect polish.

Behavior of laminated and toughened glass under static bending and impact at different velocities. R. N. HAWARD. *Jour. Soc. Glass Tech.*, **28** [127] 133–51T(1944).—The behavior of laminated glass with hard cellulose interlayers is not very different from that of sheet glass, but when a soft vinal interlayer is used, the apparent modulus of elasticity is reduced. When broken under impact just heavy enough to crack at least one of the glasses, laminated glass with a cellulose acetate interlayer again behaves in a manner similar to that of sheet glass. The interlayer resists splintering, however, and the sheet remains coherent until much higher energies of impact are applied than those required to fracture glass. With further increase in energy, the glass has a tendency to break up into a number of large pieces. Experiments show that the capacity of laminated glass to resist a blow of a given energy is markedly increased at velocities above 20 m.p.h. Under bending, heat-toughened glass behaves similarly to sheet glass except that the bending strength is approximately doubled. Under slow impact, the strength is also great, but there is a drastic reduction in strength when the incident velocity is over 20 m.p.h. The various properties of toughened glass can be quantitatively explained on the assumption that it behaves like sheet glass with a constant compressive stress at the surface. See *Ceram. Abs.*, **24** [1] 7 (1945). W.R.B.

Continuous tank for hand-blown glass. F. G. SCHWALBE. *Jour. Amer. Ceram. Soc.*, **28** [6] 151–55 (1945).—1 reference, 3 figures.

Dielectric losses of different glasses in the short-wave range as dependent on temperature. M. J. O. STRUTT AND A. VAN DER ZIEL. *Physica*, **10** [6] 445–50 (1943); abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1066.—The dielectric constant, ϵ, and the loss angle, $tg\delta$, were measured between 50° and 260°C. for heavy lead glass, a Na-containing glass (70 SiO_2, 16% Na_2O), and a B-containing glass (65 SiO_2, 23% B_2O_3) in the range 12,000 to 50,000 kc. In all cases, $tg\delta$ increases with temperature, and $tg\delta$ and ϵ change the less with temperature the higher the frequency. The Na glass has a higher $tg\delta$ than the other two glasses. M.HA.

Energy additivity in glasses. MAURICE L. HUGGINS AND KUAN-HAN SUN. *Jour. Amer. Ceram. Soc.*, **28** [6] 149–51 (1945).—3 references, 2 figures.

Glass blowing with the blowpipe. R. GERBAUT. *Glaces et Verres*, **16** [72] 12–15 (1943); abstracted in *Chem. Zentr.*, **1944, I** [1] 1.—The first description of glass blowing with the blowpipe was given in 1770 by Abbé Nollet. Treatises on the art were written by Van Swenden (1771) and later by Réaumur, Lavoisier, and others. In France, the professional glass blower appeared only at the beginning of the 19th century, and up to 1914 all medical thermometers were imported from Germany. Glass-blowing tools and techniques are described briefly. M.HA.

Glasses colored with Nd_2O_3 and Cr_2O_3. V. ČTYROKÝ AND M. FANDERLIK. *Sklářské Rozhledy*, **20** [7] 121–25 (1943); abstracted in *Chem. Zentr.*, **1944, I** [5] 308.—In continuation of former investigations of glasses with Cr_2O_3 and Nd_2O_3 additions, the following results were obtained. Cr_2O_3 addition to Nd_2O_3 glass shifts the tint toward green. In glasses 5 mm. thick the influence of Cr_2O_3 is small; the glass becomes neutral gray, but the effect increases with

increasing thickness, producing a green color. The Cr addition makes Nd_2O_3 glass lose its double colorization. See *Ceram. Abs.*, **19** [6] 136 (1940); "Effect . . . ," *ibid.*, **23** [10] 167 (1944). M.HA.

Glasses regarded as colloids. A. BOUTARIC. *Génie Civil*, **119**, 6–9 (1942); *Brit. Chem. Phys. Abs.–B*, **1942, I**, Nov., 465.

Glass-lined steel fabrication. G. L. DAWSON, JR. *Steel Processing*, **31** [4] 231–37 (1945).—D. discusses the manufacture of glass-lined steel tanks and other equipment. Some space is devoted to a historical account of the development of the steel tank suitable for lining with glass. A step-by-step description of the lining process is given, and D. concludes that through the development of new glass, new techniques, and better methods of fabrication, the field of use for glass-lined steel equipment will continue to expand. 1 diagram, 11 photographs. M.R.

Glassmaking at 2000°C. J. H. PARTRIDGE AND O. ADAMS. *Jour. Soc. Glass Tech.*, **28** [126] 105–12T(1944).—To melt small quantities of glasses having very low thermal expansion, furnaces capable of developing 1800° to 2000°C. were necessary. Two types described have tungsten grid heating elements, and two are small glass-tank furnaces. The first of the tank furnaces was heated with an oxygen-gas burner of special design, the body of the furnace being built of zircon blocks. In the second improved type of small tank furnace, heat was supplied by tungsten-rod electrodes with the glass as resistor as well as by a single oxygen-gas burner. The upper limit of temperature, 2000°C., was controlled by the refractoriness of the zircon blocks lining the tank. W.R.B.

Glass stoves loom as possibilities as result of research. ANON. *Sci. Amer.*, **167**, 124 (1942).—A glass stove has been developed with transparent plate glass for the oven door and vision top, an opaque structural flat glass for the oven's inner walls, translucent plate glass with a light back of it for the inside back, and an instrument panel of translucent glass. The glass oven retains more heat and is more even in temperature than the metal oven. W.D.F.

Glassy matrix in tank blocks. J. H. PARTRIDGE AND K. SEAL. *Jour. Soc. Glass Tech.*, **28** [126] 119–32T (1944).—An attempt was made to ascertain the degree of fluidity of the glassy matrix in specimens of tank blocks and to try to correlate it with their resistance to corrosion by molten glass. Differences in rate of creep under a tensile stress of 500 gm. per sq. cm. at 1350° were observed in specimens of refractory blocks in glass-tank walls. It is concluded that the face of a tank block exposed to molten glass consists of crystals set in a matrix which must be viscous glass rather than a solid at the temperature of tank-furnace operation. The effect of an addition of substances to sillimanite-clay mixtures to produce denser tank blocks and to promote crystallization of mullite was investigated from the viewpoint of resistance to creep at high temperatures and to corrosion by molten glass. It is suggested that a more resistant block will be produced by firing it to higher temperatures than by adding fluxing materials with the object of achieving a similar macroscopic texture at lower temperatures. W.R.B.

Heat-resisting glass in chemical apparatus. A. KUFFERATH. *Oel u. Kohle*, **37**, 755–58 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I**, June, 265.—Recent German developments are reviewed, and illustrated descriptions are given of various pieces of apparatus, piping, and joints.

Microstrength of glass. H. E. POWELL AND F. W. PRESTON. *Jour. Amer. Ceram. Soc.*, **28** [6] 145–49 (1945).—10 references, 5 figures.

Modern glass factory in Iraq. ANON. *Bull. Amer. Ceram. Soc.*, **24** [6] 223 (1945).

Physical chemistry of silicate glasses and artificial glasses. E. JENCKEL. *Angew. Chem.*, **54**, 475–78 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I**, Oct., 419.—Physical properties of silicate glasses and other organic substances behaving as supercooled liquids are compound.

Problems encountered in analysis of optical glass and glassmaking materials. J. B. BINGLEY. *Soc. Chem. Ind. Victoria, Proc.*, **41**, 342–49 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I**, June, 265.—The coloration of glass by impurities such as Fe, Ti, etc., is discussed briefly, and the chemical analysis of glass is outlined.

Retrospect and prospect. H. MOORE. *Jour. Soc. Glass Tech.*, **28** [126] 92–104T(1944).—A brief survey of the early history of glass is made, followed by a discussion of present-day advances in glass technology and proposals for future action. W.R.B.

Silver [electro-] deposit on glassware. G. GILES. *Monthly Rev. Amer. Electroplaters' Soc.*, **22** [1] 20–21 (1935); *Brit. Chem. Phys. Abs.–B*, **1942, I**, Nov., 465.—A paint made of a vegetable oil, finely ground soft glass, and precipitated Ag powder and ground for two weeks is used to coat cleaned glass. Decorative patterns can be transferred from etched steel plates. The coated glass is heat-treated for 8 hr. to remove organic matter from the paint. Ag is deposited on the treated surface at 0.11 to 0.16 amp./dm.^{2} from a solution containing Ag 45 and free CN′ 3.75 to 7.5 gm. per liter.

Solarization of glass transparent to ultraviolet rays. O. B. LOURENÇO AND F. J. MAFFEI. *Anais Assoc. Quím. Brasil*, **2**, 18–20 (1943); *Brit. Chem. Phys. Abs.–B*, **1943, I**, Dec., 490.—Uviol-Jena glass (2.4 mm. thick) exposed to light of 302 mμ is 64% transparent before and 46% after exposure for 48 hr. at 30 cm. distance.

Surface hardness of artificial glasses, Plexiglass, Reilite, and Astralon. H. PERKUHN. *Luftfahrt-Forsch.*, **20** [12] 297–99 (1943); abstracted in *Chem. Zentr.*, **1944, I** [11/12]680.—The specimens were tested for scratch hardness with the Zeiss Diritest apparatus. An automatic feed velocity of 0.3 mm./sec. was used, and the diamond point was a cone of 120°. The tests were made between 0° and 45°C. The scratch hardness test is preferable to the Vickers hardness test, as there are practically no after-effects and the width of the scratch can be measured with an accuracy of 1.5%. Loads of 10 to 100 gm. were most favorable. The hardness decreased with increasing temperature. A simple relation exists between scratch hardness (R) and tensile strength (Z): the ratio R/Z is, for a 10-gm. load at 0° to 45°C., 0.08 for Plexiglass, 0.113_4 for Reilite, and 0.157_5% for Astralon. M.HA.

Ternary diagram of the durability of Na_2O–CaO–SiO_2 glasses toward sodium carbonate solutions. M. A. BEZBORODOV. *Jour. Soc. Glass Tech.*, **28** [126] 113–18T (1944).—B. points out that determination of durability should be based on the action of water and of sodium carbonate solution. In this paper, the durability toward 0.1 N sodium carbonate solution is determined for 23 soda-lime-silica glasses of compositions within the field of those in commercial use. Results show that the relation between chemical composition and durability of glasses toward sodium carbonate solution is different from that toward water. The glass having the highest durability toward both water and sodium carbonate has the composition 15 sodium, 10 lime, and 75% silica. W.R.B.

Visualization of sintering and fusion of glass mixtures, soda, and soda slags in the heated electron microscope. K. ENDELL AND M. VON ARDENNE. *Glastech. Ber.*, **21** [6] 121–28 (1943); abstracted in *Chem. Zentr.*, **1944, I** [1] 47.—The behavior of glass mixtures was investigated under the heated electron microscope, with special consideration of soda and soda slags as alkali carriers, at 2500× magnification; no practical conclusions were drawn, as the particles were not fine enough. The eutectic fusion phenomena point to the necessity of a much more intimate mixture of the constituents of a batch. Batches of optical glass showed fusion phenomena between 900° and 1000°C. depending on composition, but changes took place at 630° while parts melted away at 890°. Quartz particles vitrified between 1500° and 1600°. Mixtures of a medium Pb glass softened at 740° and fused to the greatest part at 1010°; heavy Pb glasses gave eutectic melts at 650° and partly melted at 740°. A soda slag melted between 1020° and 1150° (16% alkalis and 18% CaO), another (27 and 8.7%, respectively) was liquid at 1010°, and a third (28 and 12%, respectively) was melted at 1120° and partly melted at 470° (apparently Na_2S particles). A soda slag of 29.9 alkalis and 9.9% CaO melted at 1000°. A green glass batch showed eutectic phenomena at 640°C. and vigorous

gas development of unknown origin at 1130°. See "Demonstration . . .," *Ceram. Abs.*, **23** [9] 158 (1944); "Sintering . . .," *ibid.*, **24** [1] 29 (1945). M.HA.

PATENTS

Apparatus for drawing glass tubing. C. H. GREENE (Corning Glass Works). U. S. 2,377,494, June 5, 1945 (May 7, 1941). 9 claims. (Cl. 49-17.1).

Apparatus for the production of glass fibers. ED FLETCHER AND N. J. LEEDY (Owens-Corning Fiberglas Corp.). U. S. 2,377,772, June 5, 1945 (July 21, 1943). 5 claims. (Cl. 13-6).

Apparatus for recording temperature. H. W. RUSSELL AND C. F. LUCKS (Anchor Hocking Glass Corp.). U. S. 2,377,376, June 5, 1945 (Oct. 31, 1941). 3 claims. (Cl. 234-1.5).—1. Apparatus for measuring and recording the temperature of gobs of glass fed intermittently from a glass feeder, comprising a photoelectric cell disposed adjacent the path of travel of the gobs whereby the gobs will move successively into the field of view of the cell, a recorder of an electrically operated type, means for interconnecting the recorder and the photoelectric cell and including an amplifying circuit, and means timed with the travel of the gobs of glass whereby the recorder will be operative when the successive gobs move into the field of view of the photoelectric cell and inoperative when the gobs move out of the field of view of the cell.

Apparatus for shaping glass articles. H. A. WEXELL AND A. H. MACLAREN (Corning Glass Works). U. S. 2,377,534, June 5, 1945 (Jan. 23, 1942). 7 claims. (Cl. 49-7).

Compound glass. I. G. FARBENINDUSTRIE A.-G. (Guido Schultze, inventor). Ger. 744,854, Jan. 27, 1944 (Sept. 5, 1941); Cl. 39*b*; abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1121.—In connection with the intermediary layer made of cellulose derivatives, e.g., acetyl cellulose, diisocyanates, e.g., hexamethylene-diisocyanate, are also used. M.HA.

Demountable cutter unit. WILLIAM OWEN (Pittsburgh Plate Glass Co.). U. S. 2,377,099, May 29, 1945 (Jan. 28, 1944). 4 claims. (Cl. 33-32).

Device for working molten glass. GLASFASERN A.-G. Swiss 227,094, Aug. 2, 1943 (March 7, 1942); abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1120.—The device is characterized in that it consists, at least at the places which are exposed to attack of the glass flow, of a material lined with a platinum metal, and the lined material is of heat-resisting steel or firebrick. The firebrick material is preferably provided previously with an electrically conductive, heat-resisting metal layer. M.HA.

Double-acting glass cutter. WILLIAM OWEN (Pittsburgh Plate Glass Co.). U. S. 2,377,098, May 29, 1945 (Jan. 28, 1944). 6 claims. (Cl. 33-32).

Electrically heated glassmelting furnace. SOC. ANON. VETRERIA ITALIANA BALZARETTI MODIGLIANI. Ital. 393,-761, March 20, 1941; abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1120.—The furnace operates continuously, whereby the charging of the glass batch into the furnace is controlled in such a manner that the thickness of the layer of molten glass in the furnace is kept constant by an electric feeler. M.HA.

Fortification of glass surfaces. F. W. ADAMS (Pittsburgh Plate Glass Co.). U. S. 2,377,062, May 29, 1945 (Feb. 27, 1943). 6 claims. (Cl. 41-42).—1. A process of fortifying surfaces of glass consisting of silica and base-metal oxides, which comprises exposing the glass to an atmosphere near the point of saturation in water, the glass being at a temperature above the dew point of the atmosphere, for a period of 1 to 3 days to form a scum upon the glass surface and then treating the surface with dilute mineral acid to remove the scum and restore the polish of the surface.

Glassforming machine. A. F. MCNISH (one half to John Moncrieff, Ltd.). U. S. 2,376,928, May 29, 1945 (July 19, 1941; in Great Britain Aug. 12, 1940). 8 claims. (Cl. 49-5).—1. A glassforming machine of the suction gathering type.

Glass of low thermal expansion. GENERAL ELECTRIC CO., LTD., AND J. H. PARTRIDGE. Brit. 568,469, April 18, 1945 (July 2, 1943).

Glass-tempering apparatus. W. R. WISNER (Corning Glass Works). U. S. 2,377,536, June 5, 1945 (Dec. 11, 1941). 2 claims. (Cl. 49-45).

Glass-treatment process. S. J. HARRIS (Holophane Co., Inc.). U. S. 2,376,872, May 29, 1945 (Oct. 20, 1942). 7 claims. (Cl. 49-89).—1. The process of treating a glass article whose opposite surfaces have unequal rates of heat abstraction per unit of projected area whereby one side tends to cool naturally faster than the other, which comprises heating the glass approximately to the softening point and then applying cooling medium to the opposite surfaces with substantially less proportionate amount applied to the side having the greater rate of heat abstraction.

Glassware-forming machine. C. C. KINKER (O'Neill Patents, Ltd.). U. S. 2,376,602, May 22, 1945 (Jan. 20, 1942). 17 claims. (Cl. 49-9).

Hermetic sealing of metal into vitreous material. SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., AND J. N. ALDINGTON. Brit. 568,448, April 18, 1945 (Sept. 17, 1943).

Laminated glass unit. L. D. KESLAR (Pittsburgh Plate Glass Co.). U. S. 2,377,084, May 29, 1945 (Nov. 5, 1940; Nov. 19, 1942). 3 claims. (Cl. 154-2.74).

Lehr loader. W. L. MCNAMARA AND F. Z. FOUSE (Anchor Hocking Glass Corp.). U. S. 2,375,936, May 15, 1945 (April 29, 1944); divided out of U. S. 2,363,681, Nov. 28, 1944 (Oct. 31, 1942). 2 claims. (Cl. 198-24).

Lens blank and lap mounting for precision lens generating mechanisms. A. J. HOLMAN. U. S. 2,377,344, June 5, 1945 (Dec. 12, 1941). 8 claims. (Cl. 51-55).

Luminescent object. AUERGES. A.-G. Swiss 226,585; abstracted in *Chem. Zentr.*, **1944, I** [13/14] 787.—The object consists of a glass body on which a luminescent colored enamel is fired which consists preferably of 12 ZnO, 14 Na_2O, and 74% H_3BO_3. M.HA.

Manufacture of hollow glass bodies, in particular glass brick. R. SCHRÖTER. Swed. 107,768; abstracted in *Chem. Zentr.*, **1944, I** [9110] 580.—The previously formed, still hot glass brick are joined, at the open side, to a drawn or rolled glass plate which must be so hot that it fuses directly at the contact points with the brick. This fusing process is best carried out immediately after the glass plate is delivered from the rolls or drawing device. M.HA.

Manufacture of objects of light-diffusing glass. OESTERREICHISCHE GLASFABRIKEN UND RAFFINERIEN JOSEF INWALD A.-G. (Karl Duldner and Roman Wadelka, inventors). Ger. 743,907, Jan. 5, 1944 (March 13, 1937); Cl. 32*b*; abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1120.—Lamp bulb, casing, and illuminating glasses are made by depositing on the surface and causing to adhere by fusing glass particles which have a slightly lower softening range than that of the object, characterized in that glass particles free of added materials are fritted or fused to the object in such manner that the single particles penetrate into the softened layer. The fired-on glass particles are then removed again by treating the surface with an agent which dissolves glass but does not frost it (diluted HF). M.HA.

Method and device for manufacturing irregularly curled threads of glass. GLASFASERN A.-G. Swiss 226,663, July 16, 1943 (Sept. 7, 1938); abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1120.—The method consists in continually changing the composition of a molten glass mass in the pot in such manner that the glass flowing out of the pot through orifices and worked into threads shows a varying composition in the section of the thread, and irregularly curled threads form. The change in composition is brought about by introducing a molten glass mass of different composition than that in the pot but can also be effected by introducing a solid glass mass of different composition or chemicals. M.HA.

Mineral wool apparatus. F. C. FREEMAN AND A. B. RIEGER (Johns-Manville Corp.). U. S. 2,376,043, May 15, 1945 (Nov. 25, 1942). 5 claims. (Cl. 49-55).

Parting agent in cellular-glass manufacture. W. D. FORD (Pittsburgh Corning Corp.). U. S. 2,377,076 May

29, 1945 (March 4, 1943). 2 claims. (Cl. 49-65).—1. In a process of forming cellular glass by heating a mixture of pulverulent glass and a thermally decomposable gassing agent to a temperature of about 1500° to 1600°F. in a heat-resistant mold, the step of preliminarily coating the mold with a film of chemically hydrated bauxite as a parting agent between the mold surface and the cellular product.

Process and apparatus for the manufacture of curled glass threads. ALLGEMEENE KUNSTVEZEL MIJ. N. V. Swiss 226,881, Aug. 2, 1943 (Aug. 4, 1939); abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1120.—The glass issuing from the orifices as a thread is passed in the still plastic state through rolls having meshed teeth on the surfaces so that the threads become curled. The threads are then put, in loose condition, on a conveyer belt and compressed by rolls into a denser layer. M.HA.

Tempering glass articles. ALBERTO QUENTIN (vested in the Alien Property Custodian). U. S. 2,375,944, May 15, 1945 (Jan. 19, 1940; in Italy Jan. 24, 1939). 6 claims. (Cl. 49-89).

Transparent glass for lamps, especially for automobile lamps. ROBERT BOSCH G.M.B.H. Belg. 442,946; abstracted in *Chem. Zentr.*, **1944, I** [11/12] 681.—To prevent undesirable reflections, a thin layer of an alkali fluoride is applied to the glass. M.HA.

Structural Clay Products

Bridge conserves critical materials. ANON. *Eng. News-Record*, **134** [9] 293 (1945).—A bridge was built in Canton, Ohio, without the use of critical materials. Constructed of concrete and vitrified paving brick, it is a two-span, three-centered arch, each having a clear span of 28 ft. and a rise of 9 ft. The brick arches are laid up with a push joint of 1:2 mortar, and the rows are bonded with header courses located wherever two courses lined up. It is believed that the vitrified paving brick will successfully resist the damage of the elements and industrial wastes and acids. G.A.K.

Looking over a brick plant—A.D. 2000: I–III. ANON. *Brick & Clay Record*, **106** [2] 34–35; [3] 46, 48, 63; [4] 39–40 (1945). B.C.R.

Power costs in brick plants. CHARLES LAKE. *Brick & Clay Record*, **106** [2] 31–33 (1945).—In using purchased electrical power, savings can be effected if the efficiency with which the power is used can be improved. Low-speed induction motors and underloaded motors are the worst offenders in causing an undesirable power factor; installation of a shunt capacitor or the use of synchronous motors will remedy this situation. In certain localities the use of natural gas engines is more economical than purchasing electrical power. B.C.R.

Simplified practice is proposed for clay pipe. ANON. *Eng. News-Record*, **134** [16] 553 (1945).—A simplified practice program now being organized by the clay pipe industry proposes a reduction in the number of items to be manufactured from 1500 to 519. G.A.K.

Refractories

Developments in installing open-hearth bottoms; recent rammed installations. WILLIAM C. KITTO ET AL. *Proc. Natl. Open Hearth Conf., Amer. Inst. Mining Met. Engrs.*, **25,** 50–52 (1942).—One installation has 16 in. of Ramix and no magnesite on top; it has gone 500 heats. Another just new, has 10 in. of Ramix with 4 in. of Basifrit burned on top. Another has 7 in. of plastic KN on the brickwork and 6 in. of magnesite burned on top; this has gone 200 heats. Still another has 6 in. of KN and 12 in. of sintered material; this has been changed in more recent installations to a 3-in. layer of sintered material. A monolithic subbottom with Ramix has 63 to 65% MgO in it; it is necessary to add some slag in order to sinter the bottom properly. W.D.F.

Developments in the manufacture of better refractories for the Portland cement industry. L. TSCHIRKY. *Pit and Quarry*, **37** [7] 135–37; [8] 79–81, 84; [9] 96, 98, 100; [10] 75–78; [11] 74, 76, 78, 80 (1945).—T. discusses the use of refractory linings in Portland-cement manufacturing equipment but centers his attention on kilns. The most severe refractories problems are encountered in the kiln itself. The various functions and service conditions of successive sections of the kiln lining are considered. Some features, facts, and actual experiences are presented that may aid in selecting the grade of refractory best suited to the service intended. The thickness of kiln lining is carefully considered, and emphasis is laid on the manner of installing linings. This involves, among other things, the shape of brick to be used. Inasmuch as a kiln is an extremely sensitive furnace, its efficient operation for reasonably long periods depends, in large part, on the human element. Operating suggestions are given, including the warning as to bringing a refractory lining up to operating temperature slowly and gradually. A few extra hours added to the heating-up period usually adds many valuable hours in ultimate over-all lining life. Good housekeeping in the storage of refractories and in working in and about kilns is urged. 30 illustrations. See *Ceram. Abs.*, **24** [2] 42 (1945). M.R.

Furnace repairs. I. C. JOHNSTON ET AL. *Proc. Natl. Open Hearth Conf., Amer. Inst. Mining Met. Engrs.*, **25,** 73–78 (1942).—By using rib brick 6 in. longer than roof brick and a special silica cement, roof life was increased from 197 to 241 heats. The use of soot blowers in the flues on a furnace with small checkers increased roof life about 50 heats. Basic refractories are finding more use for parts that fail too quickly, such as end panels and front walls. The use of Metalcase brick increases furnace life. Conveyers are used to speed up furnace repairs. Cardox is better than dynamite for blasting a slag pocket. Careful scheduling of repairs makes it possible to have a minimum number of furnaces down at one time. W.D.F.

Hydration of tubular-kiln magnesite by the autoclave method. E. KORTT AND A. DRAZHNIKOVA. *Ogneupory*, **1936,** 297–300; *Brit. Chem. Phys. Abs.–B*, **1943, I,** Feb., 67.—Particles of 1 mm. or less were hydrated in a slacking drum of a silicate brick plant with a vapor pressure of 2 atm. for 3 hr. and 1.5 hr. and of 4 atm. for 1 hr. Good-quality brick was obtained from such material.

Interaction of kaolin and coal at high temperatures. P. P. BUDNIKOV AND F. Z. DOLHART. *Compt. Rend. Acad. Sci. U.R.S.S.*, **32,** 53–56 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I,** Nov., 466.—Appreciable quantities of SiC and α-Al_2O_3 were formed when a kaolin and a clay were each heated with 25% of oil-gas coke at 1650° to 2000°.

Monolithic rammed doors. I. C. JOHNSTON ET AL. *Proc. Natl. Open Hearth Conf., Amer. Inst. Mining Met. Engrs.*, **25,** 82–84 (1942).—KN is used at one place; the doors have studs every 3 in. to help hold the refractory. They lasted 70 to 80 days. At another furnace water-cooled doors gave about 100 heats. One large water-cooled door lasted 50 heats as against 6 without cooling. W.D.F.

More alumina from bauxite by sintering "red mud." ANON. *Eng. Mining Jour.*, **146** [3] 78–80 (1945).—The red mud waste from the Bayer process is re-treated to recover additional alumina, and this allows the utilization of high-silica bauxites. It contains insoluble sodium aluminum silicate, iron, and titanium. By this method it is possible to recover as much alumina from high-silica bauxite as was originally obtained from high-grade bauxite. 3 illustrations. See "Bayer . . .," *Ceram. Abs.*, **24** [4] 73 (1945). W.D.F.

Refractory linings for rotary cement kilns: II. W. F. ROCHOW. *Rock Products*, **48** [3] 53, 126–27 (1945).—The procedure for installing the lining for a rotary kiln is described, the essential requirements being that (1) the lining should rest firmly against the shell at all points and (2) tight construction should be obtained throughout. Installation of the lining is started at the discharge end and proceeds in sections of 8 to 10 ft. for each setting of the jacks. Rotary kiln blocks are laid dry and grouted with an air-setting refractory cement after installation to prevent the penetration of Portland cement, the thermal expansion of which is sufficiently high to cause some pinching or spalling. Because of the greater coefficient of expansion of steel, no provision for the expansion of fire-clay or high-alumina brick is necessary; with basic brick some provision for expansion must be made. The use of insulation in the burning zone still remains somewhat questionable. Insulation beyond the burning zone can be used successfully through the use of retaining bars to prevent a shifting of the lining. For Part I see *Ceram. Abs.*, **24** [4] 74 (1945). B.C.R.

Resistance of refractory materials of electric furnaces. G. M. VAĬNSHTEĬN. *Repts. Central Inst. Metals Leningrad*, No. 18, pp. 17–28 (1935); *Brit. Chem. Phys. Abs.–B*, **1942, I,** Nov., 467.—The suitability of various materials for the roof of electric furnaces used in refining Fe-Cr was tested. Dinas clay and Alundum are destroyed at 1800° to 1900°, while magnesite cracks with small temperature variations and has a low electrical resistance at high temperature.

Silicon carbide roller hearths for high-temperature industrial furnaces. MATTHEW L. SNODGRESS. *Ind. Heating*, **12** [5] 834–36 (1945).—The silicon carbide roller consists essentially of a tube of silicon carbide supported concentrically on a hollow steel shaft by high-temperature insulating refractories; the size of the roller is made to fit load and temperature requirements. Two general types of insulating refractories are used, one for 2600° and one for 2800°F. The hollow steel shaft is water-cooled. The heat loss of the silicon carbide roller (due to the cooling) is only about 5 to 10% of the loss on rollers previously used. The silicon carbide retains its strength up to 2500°F. and does not appreciably lose it after several hundred degrees increase in temperature. Such silicon carbide rollers for conveying material through furnaces or kilns increase the efficiency due to the elimination of sensible heat losses. M.HA.

Steel industry talks about refractories. ANON. *Brick & Clay Record*, **106** [2] 43–45 (1945).—A survey of the postwar needs of the steel industry for refractories indicated (1) little or no decrease in refractory consumption, (2) a possible trend toward greater use of basic brick, (3) higher quality of refractories, (4) increased use of chrome and of dolomite materials, (5) greater uniformity in size, burn, and physical and chemical properties, and (6) greater density, i.e., lower porosity, for all types of refractories. B.C.R.

Suspended roof construction in open-hearth checker chambers. I. C. JOHNSTON, ET AL. *Proc. Natl. Open Hearth Conf., Amer. Inst. Mining Met. Engrs.*, **25**, 78–79 (1942).—One chamber has had a suspended roof for seven years; it increased checker volume and is easily repaired. In another installation, arch construction gave 5800 heats and suspended roof 12,500, but the cost was double. The cost of steel should be lowered. A suspended arch for the whole furnace ran from 250 to 300 heats. It cost three times as much, and some trouble was experienced with breaking brick. W.D.F.

Topaz of the Inhandjara mine: possibility of its use as a refractory material. F. B. ANGELERI. *Anais Assoc. Quím. Brasil*, **2**, 42–47 (1943); *Brit. Chem. Phys. Abs.–B*, **1943, I,** Dec., 491.—Topaz occurring at Itupeva (São Paulo) has a density of 3.56 and a hardness (Mohs) of 7 to 8 and contains SiO_2 32.8, Al_2O_3 53.2, TiO_2 0.2, Fe_2O_3 2.2, and F 18%. Heating in an oxidizing atmosphere eliminates F, and the residue is suitable for use in the ceramic industry. Preliminary experiments indicate that a mixture of topaz and clay can produce a useful refractory material.

Use of fluorine from topaz of Inhandjara mine. L. BARZAGHI AND F. B. ANGELERI. *Anais Assoc. Quím. Brasil*, **2**, 117–20 (1943); *Brit. Chem. Phys. Abs.–B*, **1944, I,** Feb., 58.—Topaz from Itupeva approximates $(AlF)_2SiO_4$ and contains 18% F. Improvement of the refractory properties of topaz by calcination raises the Al content to 70% with liberation of SiF_4, which is collected in H_2O with formation of H_2SiF_6 and H_2SiO_3.

Variation of apparent porosity through a slip-cast sillimanite tank block. J. BOOW AND G. E. WALKER. *Jour. Soc. Glass Tech.*, **28** [127] 152–57T (1944).—Apparent porosity determinations were made on 45 representative specimens of slip-cast sillimanite tank block, and they were repeated after the samples had been subjected to each of three successive refining treatments at 1500°C. for 4 hr. The mean value for the whole block, as received, was 20.3%, but individual values ranged from 18.9 to 21.4%. Highest values occurred 6 to 9 in. from the bottom, and mean porosity values at 1, 3, 6, 9, and 11 in. were 19.8, 20.4, 20.5, 20.6, and 20.1, respectively. Prolonged firing gradually decreased the porosity of each specimen. It is concluded that particular attention must be paid to the attainment of greater uniformity of composition and texture and also to firing conditions if a block of uniform quality is to be produced. W.R.B.

Wartime production of constructional steels in the basic electric furnace: I, II. H. W. MCQUAID. *Blast Furnace & Steel Plant*, **31** [6] 641–44; [7] 776–79 (1943).—McQ. summarizes the advantages of the basic electric furnace, suggests ways of improving time and quality of the heats, and reviews current melting practices. The contour of furnace bottoms and walls should be designed for fast melting. The angle of side and back walls should be steeper than is generally the case. This promotes the use of a higher and wider bottom, which in turn facilitates faster melting of scrap. A high degree of oxidation seems to produce the cleanest steel. Silicon will be reduced to almost zero. At the end of the oxidation period, the temperature should be close to 2900°F. C should be 10 points below the desired minimum, Si close to 0, and residual Mn about 0.20%. Silicates can best be eliminated by combining with manganese oxide. One way to do this is to use a manganese or spiegel reboil. B.L.

PATENTS

Alumina. HOUDRY PROCESS CORP. Brit. 568,978, May 9, 1945 (July 5, 1941).

Ceramic mass of sericite. SIEMENS-SCHUCKERTWERKE A.-G. Ger. 740,401; abstracted in *Chem. Zentr.*, **1944, I** [5] 309.—The ceramic body of sericite, also mixed with talc and other substances, is characterized by an addition of alumina preferably in amounts of 10 to 30%. The alumina can be added in calcined or molten form. The mass can easily be worked in the dry-press process and gives a dense, homogeneous body. M.HA.

Heat-resistant mortar mixture. J. J. A. TALBOT. Brit. 531,039, Jan. 8, 1941 (July 10, 1939); abstracted in *Chem. Zentr.*, **1944, I** [6] 377.—A mixture of slag wool and asbestos is moistened with a solution of Na or K silicate, and the whole, after the addition of Fe powder, is ground in a wet state until it has a pasty condition. A suitable composition is, e.g., 30 slag wool, 25 asbestos, 15 iron filings, and 30% K silicate solution of about 66° Tw. M.HA.

Making magnesia from dolomite. A. M. THOMSEN. U. S. 2,377,592, June 5, 1945 (Jan. 7, 1942). 2 claims. (Cl. 23-201).

Preparation of alumina from clay. R. J. DAVIES, H. O. DERING, AND T. W. PARKER (English Clays, Lovering, Pochin & Co., Ltd.). U. S. 2,375,977, May 15, 1945 (Nov. 3, 1942; in Great Britain Dec. 1, 1939). 4 claims. (Cl. 23-143).—1. A process for converting ammonium alum to granular alumina which comprises passing a solution of ammonium hydroxide and ammonium sulfate through a relatively thick stationary bed of ammonium alum crystals from one side to the other, the thickness of the mass and the rate of introduction of the ammonia solution being so adjusted that the reaction proceeds in a zone which gradually advances from the inlet side of the mass to the

outlet side, whereby a concentrated solution of ammonium sulfate containing only a small amount of dissolved alum and free from colloidal alumina is obtained at the outlet until the reaction is completed.

Production of alumina. A. W. HIXSON AND RALPH MILLER (Chemical Foundation, Inc.). U. S. 2,376,696, May 22, 1945 (June 10, 1942). 16 claims. (Cl. 23-143).—1. A method of producing alumina from argillaceous material relatively high in silica which comprises roasting the material, leaching the roasted material with hydrochloric acid, evaporating the leach liquor to a degree sufficient to crystallize between 50% and 80% of the contained aluminum chloride, separating the crystals from the mother liquor, evaporating the mother liquor to dryness, washing the residue with concentrated hydrochloric acid to dissolve the impurities, separating the remaining aluminum chloride from the acid wash, and thermally decomposing such aluminum chloride together with the aluminum chloride crystals separated from the mother liquor to produce anhydrous alumina and hydrogen chloride.

Terra Cotta

Thermo-remanent magnetization of terra cotta. E. THELLIER. *Compt. Rend.*, **213,** 1019–22 (1941); *Brit. Chem. Phys. Abs.-B*, **1942, I,** Oct., 420.—When terra cotta is cooled in a magnetic field it acquires a permanent magnetization called thermo-remanence. When it is reheated, the magnetization disappears. The magnetic moment of a brick heated to 670° and cooled to 20° in the earth's field remains the same even if the brick is reheated to $\geq 670°$ and again cooled in the same field. If it is heated to 670° in a weak field, H, and then heated to a temperature, θ, $<670°$, followed by cooling in the absence of a field, the original magnetization is decreased by an amount equal to that which the substance would have acquired in cooling from θ in the field H. See "Permanent . . .," *Ceram. Abs.*, **13** [10] 276 (1934).

PATENTS

Catalytic body. A. M. FAIRCHILD (Sears, Roebuck & Co.). U. S. 2,148,342, Feb. 21, 1939 (July 22, 1937); abstracted in *Brit. Chem. Phys. Abs.-B*, **1943, I,** Jan., 8.—A porous ceramic body for lowering the boiling point of hydrocarbons by partial flameless combustion and suitable for use in stoves or internal-combustion engines has dispersed in it compounds of La and of the Pt-group metals (as primary actifiers) and of Li, Mg, or Cr as secondary activators.

Whiteware

Composition of porcelain and analogous bodies. W. FUNK. *Naturwissenschaften*, **29,** 18–27 (1941); *Brit. Chem. Phys. Abs.-B*, **1942, I,** Oct., 420.—A review.

Influence of glaze on strength of steatite tubes and new method of determining glaze stresses. J. J. GINGOLD AND E. J. HIRSH. *Jour. Amer. Ceram. Soc.*, **28** [6] 168–70 (1945).—3 references.

BULLETIN

Research in Steatite Porcelains: I, Study of the firing behavior of the clinoenstatite field employing talc minerals, magnesia, and silica; II, Study of the talc minerals in steatite bodies. JOHN O. SEMMELMAN, JOHN WILLIAM LENNON, AND ARTHUR S. WATTS. *Ohio State Univ. Eng. Expt. Sta. Bull.*, No. 117, 47 pp. (1943).—A body was sought with a long firing range and uniform shrinkage. Clinochlore was added to improve plasticity; a refractory pure talc was best, and Eyrite served as a plastic agent. The best body had 60 talc, 20 clinochlore, 5 silica, and 15% Eyrite. The fired body has clinoenstatite as its chief crystal phase. Talc or steatite, when fired, produces clinoenstatite and glass. Thirty different talcs were fired by themselves to determine how impurities affect firing characteristics. Then the talcs were put in a standard body and fired. The standard body was talc 76, clinochlore 19, and Eyrite 5%. The different talcs were substituted, and careful comparison was made of their properties. Georgia kaolin is preferred to clinochlore as a source of alumina. Bentonite is better than Eyrite. Uniform talc is needed, gained if necessary by blending several. Talc containing high lime, feldspar, or clay is to be avoided. See *Bull. Amer. Ceram. Soc.*, **22** [11] 371–72 (1943). W.D.F.

PATENTS

Aluminous material. J. A. HEANY (Heany Industrial Ceramic Corp.). U. S. 22,648, June 5, 1945 (April 6, 1943); reissue of original U. S. 2,278,442 ("Process . . .," *Ceram. Abs.*, **21** [6] 116 (1942)). 25 claims. (Cl. 106-62).—1. A vitreous-like, dense, nonporous, hard ceramic article containing 80 to 99% Al_2O_3, 0.6 to 12% SiO_2, and 0.4 to 8% MgO, possessing a conchoidal fracture and a hardness of at least 71C on the Rockwell hardness-testing machine, formed of conglomerated coherent particles, the major proportion of which having a diameter less than 50 microns.

Apparatus of great hardness and insulating capacity. STAATLICHE PORZELLAN MANUFAKTUR BERLIN. Ger. 738,970; abstracted in *Chem. Zentr.*, **1944, I** [7/8] 467.—The apparatus is made of a mixture of 50 to 85 parts of a pure alkali-free calcined alumina very finely ground and preferably mixed with a small amount of alumina hydrate and 17 to 57 parts of pure kaolin, fired at 1700° to 1800°C. M.HA.

Apparatus for manufacturing pottery ware. W. J. MILLER (Miller Pottery Engineering Co.). U. S. 2,376,800, May 22, 1945 (Jan. 13, 1944). 36 claims. (Cl. 25-22).

Attachment of ceramic insulators to metal containers or sheet-metal supports. TELEPHONE MFG. CO., LTD., AND C. O. L. WARD. Brit. 568,715, May 2, 1945 (Oct. 15, 1943).

Connection between a metallic part and a ceramic body. AKT.-GES. BROWN BOVERI & CIE. Ital. 395,516; abstracted in *Chem. Zentr.*, **1944, I** [11/12] 675.—At the joint of the two parts a glass or enamel flux is used as filler which has a thermal expansion equal to that of the ceramic body and smaller than that of the metal. At the actual place of joint, a soft metal (Cu) is inserted that has a greater adhesion to the glass or enamel flux and a greater elasticity than the metal to be joined to the ceramic body. M.HA.

Heat-resistant cement for mounting sockets (metal bodies) on the walls of vacuum tubes. TELEFUNKEN-GES. FÜR DRAHTLOSE TELEGRAPHIE M.B.H. Fr. 881,189; abstracted in *Chem. Zentr.*, **1944, I** [11/12] 675.—The cement consists of more than 15% (15 to 25) graphite, more than 5% (10) water glass, and fillers, such as kaolin, quartz powder, kieselguhr, Al_2O_3, dolomite, and $CaCO_3$. M.HA.

Manufacture of small Al_2O_3 objects. LÖWE RADIO AKT.-GES. Fr. 885,833; abstracted in *Chem. Zentr.*, **1944, I** [7/8] 467.—The previously dried Al_2O_3 objects are placed in an electric furnace and heated for a few minutes to 1800° to 1900°C. M.HA.

Spark intensifier. E. M. ROBINSON. U. S. 2,376,981, May 29, 1945 (Oct. 2, 1943). 5 claims. (Cl. 123-148).

Spark-plug construction. J. J. ROSE. U. S. 2,375,822, May 15, 1945 (Sept. 18, 1943). 4 claims. (Cl. 123-169).

Spark plugs for internal-combustion engines. GENERAL MOTORS CORP. Brit. 568,455, April 18, 1945 (Nov. 6, 1942).

Equipment and Apparatus

Artificial drying and rationalization. J. MACKE. *Tonind.-Ztg.*, **67,** 150 (1943); abstracted in *Trans. Brit. Ceram. Soc.*, **44** [2] 22A (1945).—Commenting on two earlier articles on this subject, M. contradicts statements that artificial driers are uneconomical with an annual output of less than 5 million brick. He uses a drier of this type on a works with a yearly output of only 1.2 million. It was installed to increase production and reduce labor and has converted the works from seasonal to all-year-round working. The drier is heated by waste steam in daytime and live steam from a special boiler at night. A fan draws hot air from the cooling zone of the kiln, and the extra power to run this is more than compensated by the saving effected by using hot condensation water to feed the engine. Use of the fan increased the kiln performance to 3 chambers per week and improved the working conditions of the drawers. With automatic filling of the drier, the plant has been run by 12 men, most of whom were over 50 years of age.

Automatic Rockwell hardness-testing apparatus. O. WOLPERT. *Werkstattstech./Der Betrieb*, **38/23,** 128–29 (1944); abstracted in *Ind. Diamond Rev.*, **5** [53] 73–74 (1945).—A new automatic hardness-testing device was developed by the Wolpert Werke. The testing is automatic, and the test pieces are marked "correct," "too hard," or "too soft." This marking can be replaced by a three-color light signal. A selecting attachment can be provided, which automatically selects the samples and sorts them into corresponding receptacles by electromagnetic fingers. Time losses incurred by hand feeding can be avoided by attaching an automatic feeding arrangement. Normal testing time, applying all automatic attachments, is about 4 sec. per test piece, i.e., 9000 tests can be performed in 10 working hours. 1 reference. P.G.

Comparable flotation experiments with 8-hydroxyquinoline and 4-hydroxybenzthiazole as collectors. H. ERLENMEYER, J. VON STEIGER, AND W. THEILHEIMER. *Helv. Chim. Acta*, **25,** 511–14 (1942); *Brit. Chem. Phys. Abs.–B*, **1942, I,** Oct., 416.—Experiments with several minerals are described and discussed.

Design and correction of dies: I, II. L. R. WHITAKER. *Brick & Clay Record*, **106** [3] 41–45, 52; [4] 42, 44–46, 48 (1945).—Factors affecting die operations, preparation of materials for efficient die operation, methods of obtaining uniform particle size, and the effect of the size of clay particles are reviewed. B.C.R.

Device for rapid X-ray tests at high temperatures. V. A. ZUKERMAN. *Zavodskaya Lab.*, **9,** 1115–19 (1940); *Brit. Chem. Phys. Abs.–C*, **1944,** Part 1, March, 44.—The device allows X-ray photographs to be taken within 30 to 100 sec. at a temperature up to 1200°.

Electron lenses—their fundamental mechanism. W. WILSON. *Elec. Rev.*, **136** [3517] 557–60 (1945).—Electron lenses are an important feature of cathode-ray oscillographs and an essential part of television transmitters and receivers, electron-diffraction cameras, and electron microscopes. W. points out that a simple explanation of the electron lens is rendered possible only by ignoring certain factors which unduly complicate the action, such as the effect of mutual repulsion upon the trajectory of an electron stream. This discussion is consequently only an approximation but is considered quite justified for the purposes of the author. 8 illustrations. M.R.

Elutriation in the study of fine grinding. A. B. CURRIE. *Paint Manuf.*, **13,** 123–25 (1943); *Brit. Chem. Phys. Abs.–B*, **1944, I,** March, 77.—Particle size analysis of powdered materials by air and liquid elutriation is described from the theoretical and practical viewpoints.

High temperature X-ray analysis camera. E. A. OWEN. *Jour. Sci. Instruments*, **20** [12] 190–92 (1943).—A new design of X-ray camera for use with specimens at temperatures up to 1000°C. is described. The specimen under examination, in fiber form, is placed in the center of an electric furnace which is so mounted that it can be removed without disturbing the specimen, and the whole is enclosed in a chamber that can be evacuated. The camera is mounted outside this chamber and can be removed for processing the photographic film and replaced again in position without disturbing the rest of the apparatus. The specimen is made to rotate *in vacuo* by a magnetic device. Temperatures are measured with a Pt-Pt Rh couple. Samples of the structure spectra of pure iron, taken when the material was maintained at 800° and 950°C. *in vacuo*, are given. G.A.K.

Multipurpose laboratory lamp. ANON. *Laboratory*, **15** [3] 63–64 (1945).—By changing the distance between the lens and the light bulb, it is possible to produce a parallel beam, a flood of bright light, or diffused light. The lamp can be tilted either way from the horizontal by 45°. There is space for a ground-glass screen or color filters. The lens is of the Fresnel type and is made of heat-absorbing glass. With a parallel beam it produces 1000 ft.-candles. A 100-watt lamp is used. 3 figures. W.D.F.

Practical figures and calculations in drying. P. THOR AND K. SPINGLER. *Tonind.-Ztg.*, **67,** 154 (1943); abstracted in *Trans. Brit. Ceram. Soc.*, **44** [2] 22A (1945).—This is a continuation of a discussion. P. THOR: Referring to an article by K. Spingler ("Empirical . . .," *Ceram. Abs.*, **23** [9] 155 (1944)), T. questions a figure of 60 to 100 kg. of warm air, said to be requisite for drying out 1 kg. of water. He gives figures for a chamber drier showing an average of about 27 kg. of air per kg. of water. K. SPINGLER: Defending his statements, S. calculates that to achieve so much drying the air would have to enter the kiln at a temperature between 175° and 230°C. even with recirculation. The incompleteness of Thor's data is criticized.

Why the Humphreys spiral works. GEORGE W. GLEESON. *Eng. Mining Jour.*, **146** [3] 85–86 (1945).—The same thing happens in the spiral that happens in any curved stream bed or curved pipe, but the spiral exaggerates. The bottom layer of water, retarded by friction, has much less centrifugal force than the higher layers; consequently it will flow sideways across the channel, carrying with it the heavier sand. The upper mass of water must flow outward to replace it, carrying the lighter sand. The early models had four complete turns, and the later ones five complete turns. Working on chrome-bearing sands, the feed was 1.5 tons per hr. After one complete turn, the concentrate showed 90% recovery, and after four turns 98% recovery. Pulp densities, quantity of head feed, shape or size of particles, richness of heads, and other variables can fluctuate over rather wide ranges without affecting recovery or grade. In some cases prior removal of colloidal slimes improves concentration. 3 figures. See "Where. . .," this issue, p. 131. W.D.F.

X-ray crystallography equipment. ANON. *Elec. Times*, **104,** 484–85 (1943); *Brit. Chem. Phys. Abs.–C*, **1944,** Part 1, March, 44.—The principles of X-ray analysis are briefly explained, and the equipment for obtaining X-ray spectra is described and illustrated. Deviation from the correct state or composition of the material under examination is detected by comparison with a standard spectrum. The method has been successfully applied in the metal, chemical, ceramic, glass, plastics, jewelry, and rubber industries.

PATENTS

Extruding and cutting apparatus for plastic materials. G. A. BOLE, M. C. SHAW, AND H. E. COVAN (Edward Orton Jr. Ceramic Foundation). U. S. 2,377,668, June 5, 1945 (Aug. 18, 1943). 5 claims. (Cl. 25-105).

Machine for molding pyrometric cones. G. A. BOLE, M. C. SHAW, AND H. E. COVAN (Edward Orton Jr. Ceramic Foundation). U. S. 2,377,667, June 5, 1945 (Aug. 18, 1943). 11 claims. (Cl. 25-41).

Manufacturing pyrometric cones. G. A. BOLE, M. C. SHAW, AND H. E. COVAN (Edward Orton Jr. Ceramic Foundation). U. S. 2,377,666, June 5, 1945 (Aug. 18, 1943). 2 claims. (Cl. 25-156).

Spray coating machine. J. S. PETERSEN, J. W. MILLER, H. L. WENDSHUH, AND B. H. MOSER (DeVilbiss Co.).

U. S. 2,376,980, May 29, 1945 (Aug. 21, 1942). 6 claims. (Cl. 91-45).—1. In an automatic spray coating machine, a spray station, a conveyer for carrying to the spray station a series of articles to be coated, holders for the articles regularly spaced along the conveyer, a spray nozzle at the spray station for coating each article, a control valve for the spray nozzle, a series of actuator pins for the control valve, a carrier to successively bring the pins into actuating contact with the control valve, the pins being reciprocably mounted in regularly spaced relation upon the carrier and being operative when reaching the control valve in one position of their reciprocal movement and nonoperative in another, means for synchronizing the movements of the article conveyer and the pin carrier so that a pin reaches the control valve at the same time as an article holder reaches the spray station, a finger positioned a predetermined distance ahead of the spray station along the path of the conveyer, a swingable mounting for the finger, means for yieldingly swinging the finger across the path of the articles carried by the conveyer when there is no article to hold the finger away, and a pin-setting cam associated with the finger and responsive to its position to preset the pin which will reach the control valve at the same time as the article holder, currently passing the finger, reaches the spray station.

Kilns, Furnaces, Fuels, and Combustion

Graphical combustion calculation. WERNER BOIE. *Wärme*, **66** [10] 233–37 (1943); abstracted in *Chem. Zentr.*, **1944, I** [11/12] 727.—Approximation formulas are developed for the waste-gas volume for each kilogram of fuel, weight of waste gas, required amount of combustion air, specific weight of the waste gases, and their water-vapor content, composition, and specific heat. Curves are given for different CO_2 contents as a function of lower heating value, assuming a humidity of 6 gm. of water per 1 kg. of dry air. The principles for establishing the enthalpy diagram $i - x$ are explained (where i = enthalpy and x = water content in 1 kg. dry waste gas) so that drying processes with waste gases can be calculated.

M.HA.

Heat content of the products of combustion. E. L. LULY. *Inst. Fuel War-Time Bull.*, **1944**, Feb., 98–103; abstracted in *Jour. Soc. Glass Tech.*, **28** [129] 124 (1944).—The conventional method of calculating the loss of heat in boiler flue gases consists in the application of the Siegbert type of formula, which gives reasonably accurate results without requiring the complete analysis of the fuel. If, however, the complete analysis is known, the heat content of the flue gases can be calculated more accurately, using the calorific value of the fuel and the appropriate specific heat values. Suitable formulas to carry out such calculations were suggested for the following cases: (*a*) ultimate analysis of fuel available; (*b*) proximate analysis known; (*c*) calorific value and volatile content available only; and (*d*) loss of heat due to moisture in the flue gases.

H.F. dielectric heating. A. E. L. JERVIS. *Electrician*, **133** [3474] 577–80 (1944).—The derivation of the formulas applying to high-frequency heating of nonmetallic substances is given. The basic theoretical fact is stated as follows: When a high-frequency current is passed through a dielectric, the molecules are disturbed and heat is generated by molecular friction. The higher the frequency used, the greater the number of times the molecules are disturbed per second, and the greater is the heat generated. The first step in a high-frequency heating calculation is the determination of the watts per cubic inch necessary for raising the temperature of the material. A curve gives the watts per cubic inch against time in minutes required for the temperature to reach 320°F. The formula used in calculating the values is as follows: power in watts = $(0.637Pc\Delta tV)/T$, where P = specific heat (cal. per gm. per °C.), c = density (gm. per cc.), Δt = change in temperature (°F.), V = volume (cu. in.), and T = time (min.). Curves are given showing the difference between the temperature distribution within blocks of wood heated by high frequency and steam. These indicate that with high-frequency heating, the block (1) heats up in 4 min. vs. 9 hr. and (2) is hotter on the inside than on the outside. The advantage of h.-f. heating of preforms for compression molding is stated.

	Standard infrared preheating	40 sec. h.-f. preheat (5 kw.)
Curing time	15 min.	2 min.
Pot closing time	2 min.	10 sec.

Cost figures are also given, together with two sets of sample calculations. 8 references, 20 illustrations. H.K.R.

Mechanical stoker and the utilization of coal. ANON. *Claycraft*, **18** [7] 274–77 (1945).—The mechanical stoker is discussed under the following topics: (1) fuels, (2) ratings, (3) the mechanical stoker in wartime, (4) fuel saving, (5) labor, (6) education, (7) price structure, (8) taxation, and (9) performance. G.A.K.

Physical and mechanical aspects of combustion. GILBERT E. SEIL. *Proc. Natl. Open Hearth Conf., Amer. Inst. Mining Met. Engrs.*, **27**, 59–75 (1944).—S. analyzes combustion in the open-hearth furnace. Combustion has four primary characteristics: (*a*) quantity of heat liberation, (*b*) flame temperature, (*c*) rate of flame propagation, and (*d*) rate of heat transfer. The flame should hug the bath and not the structural parts, and sufficient preheat should be given so that combustion is complete before the flame hits the refractories. The flame should be kept within 12 to 18 in. of the bath; to do this it is necessary to have several individual burners. The requirements for an efficient combustion system are as follows: (1) The burning system should be designed for maximum heat transfer directly to the bath. (2) Burners must be arranged for ready and quick flame type predetermination. (3) Each burner must control its own bath area with exceedingly rapid heat release. (4) The flame should be kept near the bath. (5) Constant volumes of air and fuel per second should be delivered. (6) These objectives must be obtained without alternating the heat flow. (7) An ultimate objective should be a one-way furnace with recuperators instead of checkers. (8) Flame must be perpendicular to the furnace length. (9) Flame length must be a fraction of the furnace width. S. concludes that the rate in tons per hour for an open-hearth furnace depends on (*a*) differences in heat level between the flame and the bath; heat transfer varies with the fourth power of the difference; (*b*) actual flame temperature, which should approach theoretical flame temperature; (*c*) the distance between flame and bath, since heat transfer varies inversely with the square of the distance; and (*d*) the rate at which a fuel can be burned. W.D.F.

Radiation of luminous flames: I, Literature, working hypotheses, and preliminary data; II, Measurements on model flames: results and conclusions. K. RUMMEL AND P. O. VEH. *Arch. Eisenhüttenw.*, **14**, 489–99, 533–42 (1941); *Brit. Chem. Phys. Abs.–B*, **1942, I**, Oct., 393; see *Ceram. Abs.*, **22** [11] 200 (1943).

Summary of the British Coal Utilisation Research Assn. conference on the utilization of small coals. A. COE. *Inst. Fuel War-Time Bull.*, **1943**, Dec., 63–77; abstracted in *Jour. Soc. Glass Tech.*, **28** [127] 89 (1944).—The expected output of open-cast coal for 1944–45 is 15 million tons. Coke breeze has been used in mechanical producers with the fines below $^1/_4$ in. removed; for step-grate producers fines below $^1/_4$ in. should be limited to 20%. The ash content of the breeze should not exceed 10%, and its fusion temperature, when determined in a reducing atmosphere, should not be below 1200°. If 40 to 50% of coke breeze through a $^5/_8$ in. screen is used to replace larger-sized coke, about 80% more steam is required. It also necessitates an increase in grate area and extra labor.

Underground gasification and British coal measures. M. W. THRING. *Inst. Fuel War-Time Bull.*, **1944**, Feb.,

103–104; *Brit. Coal Utilisation Assn. Bi-Monthly Bull.*, **7** [6] 208–13 (Nov., 1943); abstracted in *Jour. Soc. Glass Tech.*, **28** [129] 124 (1944).—Of the four known methods of underground gasification (sloping seam, chamber, parallel gallery, and radial methods) for horizontal seams, only the sloping seam method has proved practical. The fundamental difficulties are to ensure intimate contact between the gases and reactive carbon before a substantial proportion of the heat liberated by the first reaction has been lost and to prevent the short-circuiting of masses of coal by air and gases as the gasification proceeds. In spite of the attractiveness of avoiding underground labor and increasing the output per man, large-scale underground gasification in Britain does not appear economical, since most British coals are worth more per therm in the form of clean sized coal than when converted into cold producer gas of 100 to 150 B.t.u. per cu. ft. See *Ceram. Abs.*, **24** [3] 60 (1945); "Russians . . .," *ibid.*, **23** [5] 93 (1944).

BOOK

Industrial Electric Furnaces and Appliances: Vol. I. V. PASCHKIS. Interscience Publishers, Inc., New York 3, 1945. x + 232 pp., 158 illustrations. Price $4.90.—Special emphasis is placed upon the thermal aspects of furnace design and operation, especially in relation to uniformity of the product to be heated; the frequently unrecognized interrelations of thermal and electrical factors associated with such equipment is stressed. Principles of design are discussed in detail, and many types of practical furnaces are illustrated in diagrammatic form. Formulas are included which should prove useful for designers. The book is planned in two volumes. In a general chapter, the first volume covers the thermal, electric, and economic principles applying to all types of furnaces and appliances. A second chapter discusses arc furnaces and electrode melting furnaces; here, emphasis is placed on steel-melting furnaces. In a separate section the special design of ferroalloy furnaces is treated. The second volume will cover induction, capacitance, and resistance heating.

PATENTS

Fuel burner control system. J. M. WILSON (Minneapolis-Honeywell Regulator Co.). U. S. 2,377,535, June 5, 1945 (March 5, 1942). 20 claims. (Cl. 158-28).

Furnace. E. W. DANY AND P. S. GRUBER (Ferro Enamel Corp.). U. S. 2,375,771, May 15, 1945 (Dec. 24, 1941). 7 claims. (Cl. 263-42).

Furnaces with circulation of internal atmosphere. J. MCDONALD AND G. W. B. ELECTRIC FURNACES, LTD. Brit. 568,980, May 9, 1945 (Oct. 11, 1943).

Improvement of natural and artificial fuels. G. E. LOCHER. Belg. 447,419, July 12, 1943 (Oct. 3, 1942); abstracted in *Chem. Zentr.*, **1944, I** [11/12] 728.—The fuels are mixed with 1 to 3% catalyzers, either powdered or mixed with water, which have a disintegrating and oxidizing action. Oxides of uranium and vanadium are suitable for this purpose. M.HA.

Tunnel ovens for firing ceramic ware. GIBBONS BROS., LTD., AND G. TURNER. Brit. 568,404, April 18, 1945 (Oct. 15, 1943).

Geology

Boron compounds in industry. E. F. GÖBEL. *Rev. Quím. Ind.* [Rio de Janeiro], **12,** 308–19 (1943); *Brit. Chem. Phys. Abs.–B,* **1944, I,** Feb., 52.—A survey of the uses to which H_3BO_3 and borates are put. Imports of these substances into Brazil have decreased since 1937, being replaced by domestic supplies.

Chrome-ore deposits. ANON. *Chem. Age* [London], **51** [1325] 491 (1944).—Large veins of chrome ore, discovered last year in the Sarugen District, Hokkaido, Japan, are to be exploited by the Teikaido Manganese Mining Co. The metal content of the ore averages about 50%. A.B.S.

Clays. D. D. HOWAT. *Mine & Quarry Eng.*, **10** [3] 55–61 (1945).—H. presents a compilation of results of research on the constitution and properties of clays. *Ibid.*, [4] 81–86.—The electrophoretic behavior of clays is discussed. Illustrated. E.R.V.

Determination of the glass content of rocks. MIKLÓS VENDL. *Mineralog. petrog. Mitt.*, **55,** 193–210 (1943); abstracted in *Chem. Zentr.*, **1944, I** [5] 302.—A new method based on the principle of Rosiwal is described by which the glass content in rocks of fine but microscopically visible structural details can be determined with an accuracy of about 2%. M.HA.

Disrupted strata. A. NELSON. *Mine & Quarry Eng.*, **10** [4] 95–97 (1945).—A general discussion of faulting and its practical significance is presented. Illustrated. E.R.V.

Effect of turbulence on sedimentation. W. E. DOBBINS. *Proc. Amer. Soc. Civil Engrs.*, **69** [2] 235–62 (1943).—The basic theory of turbulent flow has been applied successfully to explain the observed vertical distribution of suspended matter in streams in which the suspended load is in equilibrium with the bed material. D. presents the results of studies made in an effort to extend the theory to explain the concentration changes in a stream or settling basin under nonequilibrium conditions. The general differential equation expressing the concentration changes during turbulent sedimentation in an infinitely wide stream is derived, and the complete solution for a certain simplified case is presented. Evidence of the validity of this solution is provided by the results of experiments which are described. 16 references, 28 illustrations. M.R.

Fluorspar deposits in the Western States. J. L. GILLSON. *Amer. Inst. Mining Met. Engrs. Tech. Pub.*, No. 1783; *Mining Tech.*, **9** [2] 28 pp. (1945).—In the ceramic industry, fluorspar is used as an opacifying agent in glass and enamel; an annual demand of 30,000 tons is forecast for the postwar period. Most western deposits are siliceous, and it is hard to meet specifications for only 5% SiO_2. No substantial production has come from Texas, although deposits are known. In New Mexico there are scores of deposits, from small to large; two produce 150 tons per day for each mine. Colorado has four centers of production. Idaho has one completely new discovery and several other known deposits. Nevada has one important, if small, producer of high-grade fluorspar, which is produced by selective mining and without blasting. Two districts in Utah produce fluorspar, and one produces museum specimens. Washington has one known deposit, and California and Montana have several each. Arizona has several deposits. Many of the small mines are owned and operated by men with only small capital, who cannot develop the mine as it should be. For milling, jigging is the exception; some sink-float mills are in operation. They use a ferrosilicon medium. 3 maps. W.D.F.

Hobart Butte—a potential source of alumina. H. G. IVERSON AND G. P. COUGHLIN. *Eng. Mining Jour.*, **146** [3] 81 (1945).—At Hobart Butte, Lane County, Oreg., there is a total of 30,000,000 tons of measured plus indicated clay with an average composition of 26.9% Al_2O_3 and 4.5% Fe_2O_3. The deposit has long been known, and high-grade clays have been mined on a small scale. The overburden is about 3,000,000 tons. The deposit consists of bedded water-laid sediments of breccia, conglomerate, sandstone, and shale. They are highly altered, and realgar and stibnite were found in some cores. See "Exploration. . .," *Ceram. Abs.*, **24** [3] 61 (1945). W.D.F.

Hydrothermal alteration of feldspars in acid solutions between 300° and 400°C. JOHN W. GRUNER. *Econ. Geol.*, **39** [8] 578–89 (1944).—About thirty experiments, largely with feldspars, were made in HCl solutions at 300° to 400°C. The concentrations of potassium and aluminum were varied to some extent. Kaolinite was formed only below 350° ± 10°C., and muscovite was formed to as high as 525°C. Pyrophyllite may form over

the range 300° to 525°C., though it may be metastable only below 350°C. Potassium feldspars are metastable (probably also sodium feldspar) at 400°C., provided the concentration of the corresponding alkalis is high. Some of these reactions take place at such low pressures that the presence of a liquid phase in the bombs is precluded. G. attempts to explain some of the reactions. B.C.R.

Impressions of mining in Cyprus. G. A. CLASSEN. *Mining Jour.* [London], **224,** 197–99 (1945).—Chromite occurs in the Troodoos range, but the deposits are small and widely dispersed. Operations have been suspended for the duration, but it is believed that there are postwar prospects. E.R.V.

Indian fire clays. R. C. DAS GUPTA. *Jour. Sci. & Ind. Research* [India], **3,** 178 (1944); abstracted in *Trans. Brit. Ceram. Soc.*, **44** [2] 19A (1945).—Fire clays are abundantly distributed in India and are extensively worked in the Rangigunj and Jharia coal fields (Bengal and Bihar) and at Jubbulpore. To a smaller extent, they are also worked at Ratucha in the Punjab and near the Than Junction in Kathiawar. Among other places where fire clays are known to be available but where they are not being utilized for making firebrick, Chanda, Bikaner, Assam, Rajamundry, and Jammu appear to be noteworthy. Some of these deposits are discussed, and analytical data on the clays are given.

Kaolin in Spain. J. MENDIZÁBAL. *Inst. Geol. Min. España Mem.*, **8,** 49–80 (1941); *Brit. Chem. Phys. Abs.–B,* **1942, I,** Sept., 383.—Output of deposits and industrial consumption in Spain are recorded.

Kazakhstan's minerals. ANON. *Chem. Age* [London], **51** [1329] 565 (1944).—At Kazakhstan, a Soviet province in west-central Asia, large reserves of bauxite, coal, abrasives, and iron ores have been found together with the world's largest vanadium deposit. Deposits of refractory clays, quartz, and limestone have also been found. A.B.S.

Metaline Falls area grows as zinc producer. JOHN B. HUTTL. *Eng. Mining Jour.*, **146** [3] 90–93 (1945).—The deposits are in northeastern Washington. Two major lead-zinc properties have been developed so far. They are replacements in limestone and are associated with jasperoid and crystalline dolomite. The ore occurs in large irregular bodies up to 100 ft. thick. Mining is done by open stope and pillar and sometimes by underhand stoping. 2 figures. W.D.F.

Topography of a quartz crystal face. S. TOLANSKY. *Nature,* **153** [3876] 195–96 (1944).—A multiple-beam interference method which can reveal submicroscopic detail upon the surfaces of crystals of mica and selenite has been applied to reveal the topographical features of a highly lustrous (100) face of a left-handed quartz crystal. The interference contours reveal considerable detail, and each kink and bend in the fringes has true topographical significance and can be interpreted accordingly. The patterns show the existence of a small number of large vicinal faces covering the entire (100) face. These are inclined to each other at very small angles varying from 0.50 to 9.00′. The surfaces of these vicinal faces are in most cases slightly curved, with radii of curvature varying from 60 to 20 meters. The visual markings characteristic of a (100) face in quartz each show their own influence upon the interference pattern, and their topographical features have been determined. The perfection of the reflected system of fringes shows that the experimental procedure employed can be applied widely to include all types of crystals with moderately large, approximately plane surfaces. G.A.K.

Vanadium extraction. W. H. DENNIS. *Mine & Quarry Eng.*, **10** [4] 87–89 (1945).—D. presents a compilation on the metallurgy of vanadium ores and on the uses of vanadium. Illustrated. E.R.V.

Where spirals replaced tables, flotation cells. I. B. HUMPHREYS AND JUDSON S. HUBBARD. *Eng. Mining Jour.*, **146** [3] 82–84 (1945).—A plant near Jacksonville, Fla., treats 5000 tons of sand daily containing 5 to 11% of heavy titanium minerals; recovery is 95%, and the concentrate grade is 92%. Humphreys spirals are used in place of tables and flotation cells; there are 174 roughers, 36 cleaners, and 12 finishers, all operated by a three-man crew per shift. The concentrate is later separated electrically into rutile and ilmenite. Incidentally, Florida ilmenite is actually more like arizonite ($Fe_2O_3 \cdot 3TiO_2$) in composition. Important elements are feed and surge tanks; two concentric pipes are used to feed the pulp in the tanks. Water goes down the inner one and forces the pulp up through the annular space. The pulp density is controlled by raising or lowering the inner pipe. 3 figures. See "Rutile . . .," *Ceram. Abs.*, **24** [6] 113 (1945); "Why . . .," this issue, p. 128. W.D.F.

SEPARATE PUBLICATIONS

Geology and Manganese Deposits of the Glade Mountain District, Virginia. RALPH L. MILLER. *Virginia Geol. Survey Bull.* No. 61, 150 pp. (1944, published 1945).—M. discusses the manganese deposits and their stratigraphic and structural environment in a part of Smyth and Wythe Counties, in the southeastern part of the Appalachian Valley. He concludes that the manganese ores resulted from the concentration of manganese originally disseminated, probably as carbonate, in the lower part of the Shady dolomite. The ore minerals are chiefly cryptomelane (psilomelane) and pyrolusite, which accumulated in the form of grains, nodules, and tabular masses in residual clay and as replacements of some thin beds of sandstone. Known production through 1942 from the district totalled 242,173 long tons of minus 35% manganese and 6665 long tons of 35 to 70% manganese. Other mineral resources include iron, lead and zinc, barite, limestone, and sand and gravel. A.C.B.

Illinois Clays and Shales as Mortar Mix. R. K. HURSH, J. E. LAMAR, AND R. E. GRIM. *Illinois State Geol. Survey Rept. Investigations,* No. 100, 55 pp. (1944).—An investigation was undertaken to determine whether typical Illinois clays and shales are satisfactory as mortar mix materials. Previous investigations of clay mortar mix are reviewed. Samples selected for the investigation were (1) representative shales, underclays, and surface clays now used in Illinois for the manufacture of clay products, (2) samples of shales and clays not used for making clay products but of interest because of their mineral composition, (3) samples representative of the kinds of clay minerals found in Illinois clays and shales, and (4) samples representative of the various ranges in particle-size distribution existing in clays and shales of Illinois. All of the mortars were prepared in the proportion, by weight, of one part of a mixture of cement and clay or shale to three parts of Ottawa sand. Variations in the amount of clay used were made by substitution of clay for a portion of the cement that would be used in a 1:3 cement-sand mortar. All of the samples in mortars containing 40% clay in the clay-cement portion required a water content between 17 and 19% for the standard flow of 100 to 115%. Over the range of mixtures examined, an addition of 0.5 to 0.6% water was necessary with each increase of 10% clay substance. Water-retention data indicate that the glacial tills are the most effective plasticizing materials in the mortar. Mortars containing 30 to 40% clay substituted for cement resisted drying out due to absorption of water by porous materials better than similar mortars containing lime, and therefore smaller amounts of these clay materials give the water-retention values required by specification. Fine grinding increases the plasticity and water-retention values. Compressive strength tests at 7 and 28 days indicated that clay and shale material in the quantities used does not prevent the progress of hydraulic setting of the cement. Finer grinding had little effect on the strength of the mortars. Mortar containing most of the samples of shale or clay in amounts up to 40% of the clay-cement portion showed greater strength than did a sample of commercial masonry cement mortar. Clay-cement mortars maintained adequate strength under natural weathering conditions and were not inferior to mortars containing equivalent amounts of lime. Bond strengths compare favorably with data reported for mortars commonly used for masonry construction. The authors conclude that Illinois clays and

shales with a wide range of mineralogical and physical characteristics can be satisfactorily used as mortar-mix materials. Highly plastic clays are less suitable than those of somewhat coarser texture. Clay containing principally kaolinite is not as satisfactory as that containing illite. 12 figures. G.A.K.

Selected Well Logs in the Virginia Coastal Plain North of James River. D. J. CEDERSTROM. *Virginia Geol. Survey Circ.*, No. 3, 82 pp. (1945).—Logs are recorded of 83 wells drilled for municipal and industrial water supplies in the area between the James and Potomac Rivers. The deepest well is 2254 ft., at Fort Monroe, in which the lowest 8 ft. is crystalline basement rock. A.C.B.

PATENTS

Purification of sand. D. S. PHELPS (Edgar Plastic Kaolin Co.). U. S. 2,257,808, Oct. 7, 1941 (July 29, 1940). 6 claims. (Cl. 209-166).—1. A method of removing iron and titanium compounds from sand comprising establishing a pulp of the sand, subjecting the pulp to froth-flotation operation in the presence of wood creosote, a sodium sulfonated mineral oil, and material of the class consisting of oleic acid and fatty acid soap to produce a froth concentrate of the compounds, and recovering the purified sand from the tailings.

Chemistry and Physics

Application of ultrafiltration in the determination of silica in slags. A. L. DAVYDOV AND E. I. KOCHUGOVA. *Zavodskaya Lab.*, **8,** 1308–12 (1939); *Brit. Chem. Phys. Abs.–C*, **1944,** Part 2, June, 61.—Slags are dissolved in HCl + HNO_3 (or fused with $NaKCO_3$) and evaporated with HCl, and the remaining syrup is dissolved in dilute HCl and ultrafiltered; the residue is ignited with the ultrafilter. The ultrafilters are made by soaking dense paper filters in 0.5% gelatin for 1 hr. and fixing in 4% formaldehyde. For the ultrafiltration a special porcelain funnel is constructed.

Colorimetric determination of boric acid with pentamethylquercitin. K. NEELAKANTAM AND S. RANGASWAMI. *Proc. Indian Acad. Sci.*, **18A,** 171–78 (1943); *Brit. Chem. Phys. Abs.–C*, **1944,** Part 2, June, 60.—H_3BO_3 is determined by comparison of the yellow color produced when its solution in anhydrous acetone is mixed with pentamethylquercitin and citric acid in the same medium with that of an aqueous solution of K_2CrO_4. The method is empirical and gives results with a maximum error of ~15% with 0.4 to 1.8 mg. of H_3BO_3.

Construction of characteristic curve for X rays. V. N. PROTOPOPOV. *Zavodskaya Lab.*, **9,** 1283–87 (1940); *Brit. Chem. Phys. Abs.–C*, **1944,** Part 1, March, 44.—The image density-light intensity curve is determined by measuring the ratio of densities of the lines of a doublet at different total intensities.

Determination of fluorine in aluminum oxide containing cryolite. V. L. ZINCHENKO AND I. I. BOGDANOVA. *Zavodskaya Lab.*, **8,** 106–107 (1939); *Brit. Chem. & Phys. Abs.–B*, **1943, I,** Sept., 367.—A rough determination (86 to 91% of theory) of F in the presence of a large excess of Al_2O_3 can be made by treating the solid substance with 0.1 to 0.12 *N* KOH, precipitating the dissolved part of $Al(OH)_3$ by $(NH_4)_2CO_3$, and determining F in the filtrate.

Determination of free carbon (graphite) in Carborundum. A. I. MIKLASHEVSKIĬ. *Zavodskaya Lab.*, **8,** 395–99 (1939); *Brit. Chem. & Phys. Abs.–B*, **1943, I,** Oct., 401.—C in silicon carbide is determined from the rate of its oxidation in O_2 at 950°.

Determination of iron in the presence of cobalt. Two-component colorimetric method. ERNEST A. BROWN. *Ind. Eng. Chem., Anal. Ed.*, **17** [4] 228–30 (1945).—A colorimetric thiocyanate method is given for the estimation of 0.07 to 0.5 mg. of iron in the presence of variable amounts of cobalt up to 90 mg. A filter-type photometer with two color filters is used to circumvent the interference of the cobalt ion color. The method is rapid with an accuracy of ±3%. 8 references, 2 figures. F.G.H.

Determination of water in hydrocarbon gases. HARRY LEVIN, KARL UHRIG, AND F. M. ROBERTS. *Ind. Eng. Chem., Anal. Ed.*, **17** [4] 212–15 (1945).—A method is described for determining water in normally gaseous hydrocarbons. It is based on the observation that when a gas containing moisture is contacted with cold dehydrated acetone, the water is retained by the acetone, in which it can be determined by reaction with acetyl chloride, titrating the liberated acid. Olefins and diolefins do not interfere, and provision is made for correcting for interference by acidic or basic constituents of the sample. 14 references, 1 figure. F.G.H.

Effect of hydrogen-ion concentration on cation exchange in clay salts. J. N. MUKHERJEE AND S. K. MUKHERJEE. *Nature*, **155** [3924] 49 (1945).—Symmetry values of a number of clay salts against various electrolytes have been measured with and without adjustment of the pH of the system by the addition of hydrochloric acid. When a constant pH is not maintained, deviations from the normal lyotrope series often occur, especially in clays containing montmorillonite as judged from X-ray analysis. The deviations disappear when the symmetry values measured at a constant pH ranging from 6.0 to 7.0 are compared. At a constant pH between 3.0 and 5.0, all the cations examined give the same symmetry value, and the cation effect as envisaged in the lyotrope series disappears. At a low pH, hydrochloric acid alone gives a higher symmetry value than when used in conjunction with the salts. Al^{+++} ions are likely to be exchanged at this pH for the cations of the added salt, but no appreciable exchange of aluminum would occur if hydrochloric acid alone were added. G.A.K.

Efficient statistical methods in chemistry. JOHN MANDEL. *Ind. Eng. Chem., Anal. Ed.*, **17** [4] 201–206 (1945).—Statistical procedures are described for the evaluation and comparison of precisions and for the estimation of accuracies. Illustrative use is made of numerical data taken from articles published in *Industrial and Engineering Chemistry, Analytical Edition*. Special emphasis is placed on the practical interpretation of the statistical tests and computations. 7 references. F.G.H.

Electrochemical properties of silicic acid sols. J. N. MUKHERJEE AND B. CHATTERJEE. *Nature*, **155** [3925] 85–86 (1945).—The titration curves of the sols with dilute bases show an inflection in the acid region at pH 4.5 to 5.5. The total acid neutralized by several dilute bases at this inflection point is a constant quantity. An inflection at pH 11.8 in the titration curves of silicic acid sol with concentrated alkali has been observed. The plot of the buffer capacity $\beta\left(=\frac{\Delta B}{\Delta pH}\right)$ against the concentration of the alkali shows a maximum near the point of half neutralization, indicating that up to the second inflection only the first stage of neutralization of H_2SiO_3 is reached. The sol behaves as a strong acid as judged from (*a*) the form of the titration curves with small additions of very dilute bases and (*b*) by the manner of variations with dilution and temperature of the free acid and the total acid at the first inflection point. A weak acid character of the sol is indicated by (1) the buffering in the range pH 6 to 8 beyond the first inflection; (*b*) the comparatively low ratio (0.5 to 0.8) of the free acid to total acid at the first inflection, which is of the order of 10^{-4} *N*; and (*c*) the manner of the variation of the pH of the sol on the addition of acids. A smaller lowering in the pH is observed on the addition of a given concentration of an acid to the sol than when added to hydrochloric acid of nearly the same pH as the sol. The amounts of acid liberated from the sol by neutral salts, as shown by the diminution in its pH on the addition of salts and by the total amount of acid found in the salt extracts, are in the order $Ba^{++}>Ca^{++}>K^{+}>Na^{+}>Li^{+}$. The total amount of acid liberated, especially by barium and calcium

chlorides, is considerably greater than that neutralized at the first inflection point in the titration curve with a dilute base. This indicates that "bound" H^+ ions are present in addition to those which can react with the base at the first inflection point. At very low concentrations, the alkali metal cations cannot easily displace the "bound" H^+ ions associated with the colloidal particles but only effect an osmotic displacement of the mobile H^+ ions. With lithium chloride, the displacement of mobile H^+ ions is complete at a concentration of 0.01 *N*. See *Ceram. Abs.*, **23** [8] 143 (1944). G.A.K.

Electrolytic determination of arsenic. M. I. KRILOVA. *Zavodskaya Lab.*, **8**, 1043–47 (1939); *Brit. Chem. Phys. Abs.–C*, **1944**, Part 2, June, 63.—As_2O_5 or As_2O_3 in dilute H_2SO_4 or in aqueous sulfate solutions is reduced to AsH_3 at a Hg cathode; AsH_3 is determined colorimetrically. The cathodic and the anodic compartments are separated by a collodion membrane.

Measurement of particle-size distribution in powders. E. G. RICHARDSON. *Chem. & Ind.*, **62** [46] 435 (1943); *Brit. Chem. Phys. Abs.–C*, **1944**, Part 1, March, 54.—R. comments on papers by Rigden and Fairs (*Ceram. Abs.*, **23** [1] 26, 31 (1944)) and gives a further limitation to the formula quoted by Rigden for the turbidimeter.

Petrographic analysis by fragment counting. FELIX CHAYES. *Econ. Geol.*, **39** [6] 484–505 (1944).—The applicability of normal frequency distribution to errors in petrographic analysis by grain count is now generally assumed. A method is described in which the error of the count is considerably smaller than would be predicted from normal distribution. From experimental error an equation exhibiting counting error as a function of the number of grains counted and the composition level is developed; these relations are represented graphically. Empirical equations developed apply only to the error of counting and take no account of variations in grain size, grain shape, and specific gravity and systematic or erratic errors in sampling. A study of microsampling is now in progress, and other analytical factors will be investigated later. With a counting method of known error as a base, experimental evaluation of other laboratory errors should be relatively simple. B.C.R.

Quantitative spectrographic method for analysis of small samples of powders. ELMORE J. FITZ AND WILLIAM M. MURRAY. *Ind. Eng. Chem., Anal. Ed.*, **17** [3] 145–47 (1945).—A method is described for the quantitative spectrographic analysis of inorganic substances using only 0.1 to 1.0 mg. of powdered sample. When applied to such small samples, the method gives sufficient accuracy for many purposes, and the saving in time is considerable. It is an adaptation of the ratio quantitative powder technique of Lewis, who synthesized powder mixtures until the resulting line intensities of a known mixture matched those of the unknown powder. The general technique consists of mixing the sample to be analyzed with a large excess of a pure powder mixture which serves as a buffer and internal standard. Weighed proportions of this mixture are then pressed into pellets which are burned in a d.-c. arc, and the spectra is prepared. Line-intensity ratios between selected spectrum lines of the sample constituents and the internal standard are determined photometrically and converted to the weight of the constituent by reference to calibration curves. Calibration curves have been prepared for ten elements, and it should be possible to extend this number to include most of the common elements which are excited in the d.-c. arc. The technique has been found satisfactory for complex rocks, slags, refractories, corrosion produots, boiler scale, ash from ignition of organic materials, and various small samples of inorganic nonmetallic powders. 4 references, 3 figures. F.G.H.

Raman spectrum of quartz. R. S. KRISHNAN. *Nature*, **155** [3937] 452 (1945).—Using the technique for Raman effect studies developed by Rasetti, in which the 2537-a.u. radiation from a water-cooled magnet-controlled mercury arc is the exciter, and prolonging the exposure to 48 hr. for a crystal 15 cm. long, K. recorded a very intense spectrum in which 41 distinct frequency shifts were observed and measured. The following table gives the measured frequency shifts in wave numbers, and the relative intensities of the lines are roughly indicated on an arbitrary scale within brackets.

Frequency shift and strength		Assignment	Frequency shift and strength		Assignment
127	[20]	E_1	859	[1]	
145	[2]		890	[1]	B_2+E_2
207	[15]	A_1	925	[1]	E_1+E_5
267	[7]	E_2	940, 960	[1]	$2A_3$, $2B_2$
			1033	[1]	
319	[1]		1065	[4]	E_6
358	[6]	A_2	1082	[3]	A_4
395	[5]	E_1+E_2	1134	[1]	
404	[5]	E_3	1160	[7]	E_7
453	[2]		1228	[3]	E_8
467	[30]	A_3	1248	[1]	
480	[2]	(B_2)	1276	[0]	A_1+E_6
500	[2]		1369	[0]	A_1+E_7
520, 546	[1]	E_1+E_3, $2E_2$	1381	[0]	
			1429	[0]	E_2+E_7
585	[1]	A_1+B_1	1456	[0]	B_4+E_2
645	[1]		1570	[0]	B_1+B_4
670	[0]	E_2+E_3	1610, 1630	[1]	$2B_3$, A_3+E_7
696	[4]	E_4			
727	[0]	A_3+E_2	2379	[1]	$2B_4$
794	[5]	E_5	2430	[1]	
805	[5]	$2E_3$, (B_3)			
834	[1]				

G.A.K.

Rogers and Caley method for lithium. Application to silicates containing lithium, sodium, and potassium. FRANK R. BACON AND DOROTHEA T. STARKS. *Ind. Eng. Chem., Anal. Ed.*, **17** [4] 230–32 (1945).—When a silicate is completely decomposed by attack with hydrofluoric and sulfuric acids, alkali sulfates can be collected quantitatively after elimination of other remaining elements. These other elements may be removed in the normal course of their determinations or more rapidly by group precipitations without determinations. Lithium can be determined by the Rogers and Caley periodate method in a solution of the alkali sulfates. If potassium is determined in a separate sample, sodium can be calculated by difference from the weight of total alkali sulfates. By this means these three alkalis are determined in the absence of others with reasonable accuracy. 7 references. F.G.H.

Selenium recovery. A. G. AREND. *Chem. Age* [London], **52** [1332] 11–14 (1945).—Selenium is obtained from pyrites and from the flue dusts which accumulate in sulfuric acid and alkali works and in metallurgical smelters. In metallurgical works where copper, lead, silver, etc., are recovered, selenium is almost completely passed to the condensing towers and tends to remain suspended in the acid liquors which flow from the bottom of the towers. To these liquids dilute sodium sulfide is added, or the liquid is made to pass over pieces of ferrous sulfide to precipitate any copper or lead which might be present and form a nucleus for collecting the suspended rarer constituents. The liquors pass around a set of settling boxes before passing to the large storage bin, from which the acid is tapped off as required. The dark-brown mud containing the selenium is allowed to collect and is then removed and dried slowly in ovens, care being taken that no "dusting" occurs; it is then packed in bags and dispatched to the precious-metal refinery, where the mass is digested in solvent liquors, such as 50° Bé. sulfuric acid, prepared hydrochloric acid, or in some cases aqua regia, and is eventually precipitated as selenium by sulfur oxide. When copper is smelted in the blast furnace, passed to the converters, and finally electrolyzed, the majority of the selenium passes to the flues, but a certain proportion is always retained in the metal and is eventually accumulated in the anode slimes. Anode slimes from other base-metal processes likewise retain the selenium, but, as most of these also contain silver, they are collected and passed to the precious-metal department. Accordingly, the bulk of selenium from all sources eventu-

ally reaches the one point. On a smaller scale, the different concentrates containing gold and silver are a direct source of selenium-enriched anode slimes; e.g., although the original ores contain only a few points per cent of selenium at the most, the Raritan refinery recovered as much as 3000 lb. of the powdered material per month, which represents one of the world's largest outputs. The anode slimes are passed into and then passed over a continuous type of rotary vacuum filter. The slime cake, generally dark brown in color, is first dried and then passed into an oil-fired roasting hearth where oxidation takes place at 370°C. The roasted mass then travels into a leaching tank containing a solution of 15% sulfuric acid, and the temperature is raised to the boiling point. The slimes are filtered, mixed with flux, and heated to dull/redness. The flux comprises a mixture approximating to 75 sodium carbonate and 25% sodium nitrate. The alkaline slag so obtained contains the bulk of the selenium and tellurium. The alkaline slag is removed as completely as possible, and the temperature is raised to a bright red heat; a compressor delivers air, which causes the antimonial lead alloy to appear to boil violently. By this action, much of the antimony is oxidized and is later removed from the surface, while the selenium passes almost completely to the flues. The flue gases are first cooled, and the solid matter is allowed to settle out, after which they pass through scrubber towers, where recirculated water carries down the solid matter in the form of a sludge. The gases then pass on to a Cottrell precipitator to recover the selenium, which is then added to the alkaline slag; the mixture is dissolved in dilute acid and filtered, and the liquid is exposed to the action of sulfur dioxide gas, which precipitates the selenium. The red or dark-brown precipitate, after washing and filtering, is carefully heated until it melts to form a black mass. When this has been sharply cooled, although in bulk appearing as a black or purple-black mass, it can be drawn, white hot, into thin sheets showing a fine red color. The vitreous modification is kept for some time at approximately 650°C., when it is converted to silver-gray selenium. A.B.S.

Spectrographic limit of detection of phosphorus, titanium, and zirconium in the direct-current arc. DANIEL P. NORMAN AND WILLIAM W. A. JOHNSON. *Ind. Eng. Chem., Anal. Ed.*, **17** [4] 233–35 (1945).—The spectrographic limits of detection of phosphorus, titanium, and zirconium have been investigated in a series of National Bureau of Standards standard samples, including dolomite, fluorspar, flint clay, silicon carbide, limestone, burned refractory, and soda-lime, lead-barium, and borosilicate glasses. The samples were weighed directly into a cored graphite electrode which was used as the cathode of a conventional d.-c. arc operated at 15 amp. The spectra were observed in the first order of a 3-meter grating spectrograph, dispersion 5.6 a.u. per mm., by a jumping-plate technique. λ2553.28 proved to be the most satisfactory spectrum line for the detection of phosphorus. When the limit of detection of an element was defined as the smallest amount which could always be detected with certainty, the limit of detection of phosphorus ranged from 0.05 to 0.80 μgm. in nine different standards containing 0.0013 to 0.59% phosphorus. λ3371.45 was the most satisfactory for the detection of titanium. The limit of detection of titanium ranged from 0.04 to 4 μgm. in twelve samples containing 0.0018 to 0.23% titanium. The optimum line for the detection of zirconium proved to be λ3391.98 of the ionized atom because the high temperature needed to volatilize zirconium favors the excitation of the ionized atom at the cost of the neutral atom. The limit of detection of zirconium was found to vary from 0.5 to 4μgm. in six samples containing 0.0037 to 0.19% zirconium. No correlation was observed between the limit of detection and the percentage of an element in a sample. 11 references. F.G.H.

Technique of intensity measurements in X-ray crystal analysis by photographic methods. J. M. ROBERTSON. *Jour. Sci. Instruments*, **20** [11] 175–79 (1943).—Various important points of technique in photographic X-ray intensity estimation are described. Many of these points are equally important whether the intensities are finally obtained by visual estimate or by measurement with some form of integrating photometer. The value of long and tedious photometer integrations is sometimes wasted unless these points are carefully observed. Matters dealt with include (1) spectrometer requirements for the preparation of reliable photographic records, (2) methods for correlating the intensities over the range of several thousand to one required for detailed structural investigations, (3) multiple film technique and development processes, (4) the calibration of films and the integration of intensities, and (5) the absolute measurement of intensities photographically by means of calibration with standard crystals. G.A.K.

Thermobarometer. Quick and exact conversion of gas volumes into weight. ERNST BERL, W. G. BERL, AND G. A. STERBUTZEL. *Ind. Eng. Chem., Anal. Ed.*, **17** [3] 166–68 (1945).—The function of the thermobarometer is to assist in the correction of gas volumes obtained in gas analytical determinations to normal temperature and pressure. It includes corrections due to temperature and pressure changes and allows for the vapor pressure of the confining liquid in the gas burette. Details of construction and operation are given. 2 figures. F.G.H.

X-ray investigation of the reaction products of tricalcium phosphate with magnesium orthosilicate. JOHAN PETTER FASTING AND HAAKON HARALDSEN. *Tids. Kjemi, Bergvesen Metallurgi*, **3**, 48–55 (1943); abstracted in *Chem. Zentr.*, **1944, I** [19/20] 1068–69.—A. tried to find out whether it is possible to obtain magnesium silicocarnotite, $5MgO \cdot P_2O_5 \cdot SiO_2$, and calcium magnesium silicocarnotite, $3CaO \cdot 2MgO \cdot P_2O_5 \cdot SiO_2$, by calcining $Mg_3(PO_4)_2$ or $Ca_3(PO_4)_2$ with mixtures of MgO and SiO_2 or natural Mg orthosilicate (olivine). For $Ca_3(PO_4)_2$, the presence of CaO and SiO_2 has a stabilizing effect on the citric acid soluble β modification, while MgO and SiO_2 stabilize the difficultly soluble α modification. $Ca_3(PO_4)_2$ and Mg_2SiO_4 form only solid solutions with each other, so that common calcining leads to the formation of α-$Ca_3(PO_4)_2$, while calcining of $Ca_3(PO_4)_2$ with CaO and SiO_2 leads to the formation of β-$Ca_3(PO_4)_2$ solid solutions or Ca silicophosphate. Apatites freed of F can also form α- and β-Ca modifications, but Mg-free apatites or Ca silicophosphates can be obtained only if it is possible to stabilize the β modification in the presence of MgO and SiO_2 or olivine. M.HA.

BOOKS

Commercial Methods of Analysis. FOSTER DEE SNELL AND FRANK M. BIFFEN, with photomicrographs by GEORGE LORD. McGraw-Hill Book Co., Inc., New York, 1944. vii + 753 pp., 152 illustrations. Price $6.00. International Chemical Series, Louis P. Hammett, Consulting Editor.—To make the book of more universal use, standard methods, such as those given in the "Methods of Analysis of the American Society for Testing Materials" and the "Methods of Analysis of the Association of Official Agricultural Chemists," have in many cases been introduced, though often not in the exact words of these methods. In line with the general scheme of the book, simplifications have been adopted in some parts, and, what is more important, explanations of steps, the reason for which is not sufficiently clear, have been given. Standard methods are not given in full, only such determinations as seem necessary to the general analyst. Particular care has been taken to set forth in logical sequence the preliminary steps that necessarily precede the actual analysis of samples of unknown composition. Endeavor is made to clarify the meaning of each step and often to give the reason for it. This is to develop the inexperienced analyst into an experienced one by logical methods and to show the importance of what may at first seem to be unimportant details of procedure, details which, if omitted, will in many cases lead to incorrect results. Methods are as simple and direct as possible, compatible with accuracy. Where data are available, limits of accuracy are discussed as to what is desirable and what is attainable for a particular type of sample or sometimes for a particular application. The practical point of view of the commercial laboratory has been emphasized by methods that aim at general economy of time and materials without sacrificing reliability of re-

sults. A feature of the book is an attempt to set forth succinctly, frequently by stating the reactions involved, the methods of calculating the results of determinations in order to show reason for the formula given. Condensation has been accomplished by profuse cross reference to methods in other parts of the book, in nearly every case to specific portions rather than to general paragraphs or chapters. Special methods have been included that have been found to be saving of both time and labor. Emphasis is also laid on the growing importance of the determination of minute quantities. The useful new branch of qualitative analysis by spot tests is condensed to one chapter (Chap. 5).

Research on Consolidation of Clays. DONALD W. TAYLOR. *Mass. Inst. Tech., Dept. Civil and Sanitary Eng.*, Serial 82, xii + 147 pp. (Aug., 1942).—The results to date of extended investigations of the action of clay during consolidation are presented. Understanding of the physical laws of clay action under loading has not yet progressed to the point of permitting more than rough estimates of amounts of settlement and rates of settlement of buildings or embankments. The direct purpose of the research reported herein is to improve understanding of the physical laws of clay behavior. The ultimate goal of such research is the development of more dependable procedures for settlement forecasting. To reach this ultimate goal, investigations are required on subjects such as the laws of transmission of stresses into the underground, which are beyond the scope of this report. Therefore the extent to which settlement analysis methods are covered herein is limited. In the final section, however, there is discussion of relationships between the new material presented and settlement predictions. Sections of Part I are devoted to brief presentations of the Terzaghi consolidation theory and the conventional consolidation test procedure used in the Massachusetts Institute of Technology Soil Mechanics Laboratory. Part II is devoted to research investigations into various phases of consolidation conducted between 1935 and 1939. These projects have helped to point out important factors affecting consolidation which are not accounted for in the Terzaghi theory. Late in the year 1939, a research project was started in which pore-pressure measurements within the consolidating sample were a main feature. Results of this research have been of special value toward better physical understanding of consolidation as it actually occurs in small laboratory samples. A report on this research and the theoretical studies which have been used to explain the observed results, with discussion of their significance with respect to practical settlement predictions, is presented in Part III. 66 illustrations.

PATENTS

Ceramic chromium-containing coloring bodies. DEUTSCHE GOLD- UND SILBER-SCHEIDEANSTALT VORM. ROESSLER. Dutch 55,194, supplement to Dutch 44,669; abstracted in *Chem. Zentr.*, **1944, I** [9/10] 579.—The ammoniacal chromate solutions used in the principal patent for precipitation should contain ammonia in at least the amount required for binding the anions of the heavy-metal compounds used and for precipitating the basic heavy-metal chromates. The filtered-off, washed, and dried precipitate can then be used without subsequent annealing directly as a ceramic pigment. M.HA.

Strontium peroxide and method of manufacturing. L. H. DAWSEY AND H. A. RUDOLPH (Buffalo Electro-Chemical Co., Inc.). U. S. 2,375,772, May 15, 1945 (June 23, 1943). 7 claims. (Cl. 52–23).—1. The process for manufacturing high density strontium peroxide which comprises reacting a soluble peroxide and a soluble strontium salt in an alkaline aqueous medium at temperatures between 50° and 75°C.

General

Ceramic lining for acid tanks. RICHARD NEUHAUS. *Petroleum Refiner*, **24** [5] 120 (1945).—The construction of linings for tanks and vessels for handling commercial acids and storage is outlined. The use of membranes, brick, and cement in the lining of acid tanks and the application of special construction to take care of temperatures up to 275°F. is discussed. R.G.C.

Chromium plating of dies and tools. D. A. COTTON. *Metal Finishing*, **41** [6] 343–47 (1942).—C. gives a detailed discussion of the salvaging of tools and dies at the Delco-Remy Co. plant at Anderson, Ind. The plating with chromium is described. The variation in plating procedure found satisfactory for different tools is stated. 12 illustrations. H.K.R.

Department of Ceramics established at University of Texas. ANON. *Bull. Amer. Ceram. Soc.*, **24** [6] 222 (1945).

Drawing compounds. G. W. DYKSTRA. *Better Enameling*, **16** [4] 4–5, 23 (1945).—Incomplete removal of the drawing compound may be due to (1) the presence of insoluble calcium, aluminum, zinc, or lead soaps, (2) insoluble pigment in the compound, (3) failure to maintain the cleaning bath at boiling temperature, and (4) failure to maintain the cleaner at the proper strength. Drawing compounds allowed to remain on enameling steel may result in (*a*) blisters, poppers, and bare spots, (*b*) boiling or blistering due to pigments, or (*c*) welding defects due to failure to remove the compounds before welding. B.C.R.

Protection through hard-surfacing: principles, uses, and procedures. W. W. MILLS. *Pit and Quarry*, **37** [11] 70–72 (1945).—Hard-surfacing as a practical means of protecting all types of steel equipment from excessive wear is proving of great value in many of the heavy industrial operations of the pit and quarry industries. M. describes the process and discusses its application to crushing, drilling, excavating, and handling equipment. 6 illustrations. M.R.

John David Ramsay. ANON. *Bull. Amer. Ceram. Soc.*, **24** [6] 187–91 (1945).—1 photo.

Report of Committee on Air Hygiene. FRED A. HARVEY, Chairman. *Bull. Amer. Ceram. Soc.*, **24** [6] 216 (1945).

Report of Committee on Patents. FULTON B. FLICK, Chairman. *Bull. Amer. Ceram. Soc.*, **24** [6] 215–16 (1945).

Report of Committee on Standards. J. W. WHITTEMORE, Chairman. *Bull. Amer. Ceram. Soc.*, **24** [6] 212–15 (1945).

Strategic and postwar ceramics. J. O. EVERHART. *Ohio State Univ. Eng. Expt. Sta. News*, **17** [2] 10–11 (1945).—The entire war program depends on refractories. Modern whiteware may contain nepheline syenite, talc, rutile, spodumene, topaz, zirconia, etc. There are non-crazing glazes, low-temperature vitreous bodies, and heat-shock-resistant ovenware. Electrical porcelains have a strength of 10,000 lb./sq. in. and higher with a dielectric constant up to 10,000. Clay pressure piping now carries pressures up to 1000 lb./sq. in. Deairing is the biggest single contribution to modern ceramic technology. Ceramic stoves promise to remain as a widely used household item. Glass is made bulletproof for armored vehicles and is used in kitchenware, insulation, fireproofing, land mines, etc. W.D.F.

Summary of design data for exhaust systems. A. D. BRANDT. *Heating & Ventilating*, **42** [5] 73–88 (1945).—B. provides detailed, specific, and simplified data and charts on the calculations involved in the design of various parts of an exhaust system. These include round or rectangular, slot and canopy hoods and ductwork. A design problem is calculated. 25 diagrams. M.R.

PATENTS

Employment of paraffin for impregnating metal-ceramic bodies. DEUTSCHE WAFFEN- UND MUNITIONSFABRIKEN A.-G. Ger. 741,600; abstracted in *Chem. Zentr.*, **1944, I**

[9/10] 590.—The bodies are impregnated with paraffin containing oxidation products, especially fatty acids. The bodies are less liable to oxidize than bodies impregnated with pure paraffin. To the impregnating substance neutral substances can also be added, e.g., graphite. M.HA.

Tank for salt melts. I. G. FARBENINDUSTRIE A.-G. Fr. 884,424; abstracted in *Chem. Zentr.*, **1944, I** [11/12] 681.—To protect the metallic tank from exterior attack it is coated with several protective layers of 3 to 4 feldspar 1 to 2 orthosilicate or water glass, 0.5 crushed firebrick, and 0.2 part graphite. The layer in direct contact with iron should contain no graphite. The individual layers are kept in place by mesh and increase from inside to outside in thickness from 1 to 2 mm. to 6 to 8 mm. M.HA.

Do You Like to Read?

Then perhaps you would enjoy abstracting. The following periodicals should be read for articles of interest to ceramists. An abstracter must have the publication available and be prepared to submit abstracts regularly each month. Address all requests for assignments to the office of *Ceramic Abstracts*, 2525 North High St., Columbus 2, Ohio.

Advances in Colloid Science
Air Conditioning and Refrigeration News
American Documentation Institute Documents
American Engineer
American Exporter
American Journal of Archaeology
American Journal of Physics
American Journal of Roentgenology and Radium Therapy
American Refractories Institute Technical Bulletin
American Review of Tuberculosis
American Soil Survey Assn., Report of Annual Meeting
American Standards
Anales de Fisica y Quimica (Spain)
Antiques
Apollo
Architect and Engineer
Architecture and Design
Art News
Arts & Architecture
Bell System Technical Jour.
Better Vision
Bituminous Coal Research, Inc., Technical Report
Brick Builder
British Journal of Radiology
British Steelmaker
Building Standards Monthly
Building Supply News
Bulletin of the Art Institute of Chicago
Bulletin of the Electrochemical Society
California Journal of Mines and Geology
Canadian Public Health Journal
Ceramic Forum
Chemical Bulletin (Chicago)
Chemical Preview
China and Glass
Combustion
Commercial America
Compressed Air Magazine
Connoisseur
Crockery & Glass Journal
Diseases of the Chest
Electrical Engineering
Electrical World
Engineer's Digest
Equipment & Materials Reporter
Food Manufacture
Geological Survey of Ohio Information Circular
Gift and Art Buyer
Grits and Grinds
Heating & Ventilating Engineer
Highway, Street and Airport Manual
Hygeia
Ice and Refrigeration
Illinois Medical Journal
Illumination
Illustrated London News
Industrial Arts & Vocational Education
Industrial Bulletin of Arthur D. Little, Inc.
Industrial Heating Engineer
Industrial Medicine
Industrial Relations
Industry and Power
Industry and Welding
Instrument Maker
Iron Age
Iron and Steel
Journal of the American Dental Assn.
Journal of the American Leather Chemists Assn.
Journal of the American Medical Assn.
Journal of the British Society of Master Glass Painters
Journal of Hygiene
Journal of Industrial Hygiene and Toxicology
Journal of the Institution of Heating and Ventilating Engineers (London)
Journal of the Institution of Production Engineers
Journal of the Iron and Steel Institute (London)
Journal of the Royal Microscopical Society
Journal of the Royal Society of Arts
Journal of the Royal Technical College (Glasgow)
Lubrication
Machine Design
Magazine of Art
Metal Industry (London)
Mill & Factory
Mining and Industrial News
Mining Journal (Phoenix, Ariz.)
Mining World
Modern Industry
Monthly Review of the American Electroplaters' Society
National Glass Budget
New England Journal of Medicine
New Equipment Digest
Occupational Therapy & Rehabilitation
Occupations
Ohio Industrial Commission Monitor
Oil & Gas Journal
Pencil Points
Proceedings of the Physical Society (London)
Refrigerating Engineering
Retailing—Home Furnishings
Review of Scientific Instruments
Revista de Chimica Industrial (Rio de Janeiro)
Revista Industrial
Rocks and Minerals
Science
Scientific Monthly
Sheet Metal Worker
Southern Power and Industry
Stained Glass
Stove Builder
Studio
Technology Review
United States Public Health Reports
Wall Street Journal
Welding Journal (New York)

THE BULLETIN SECTION

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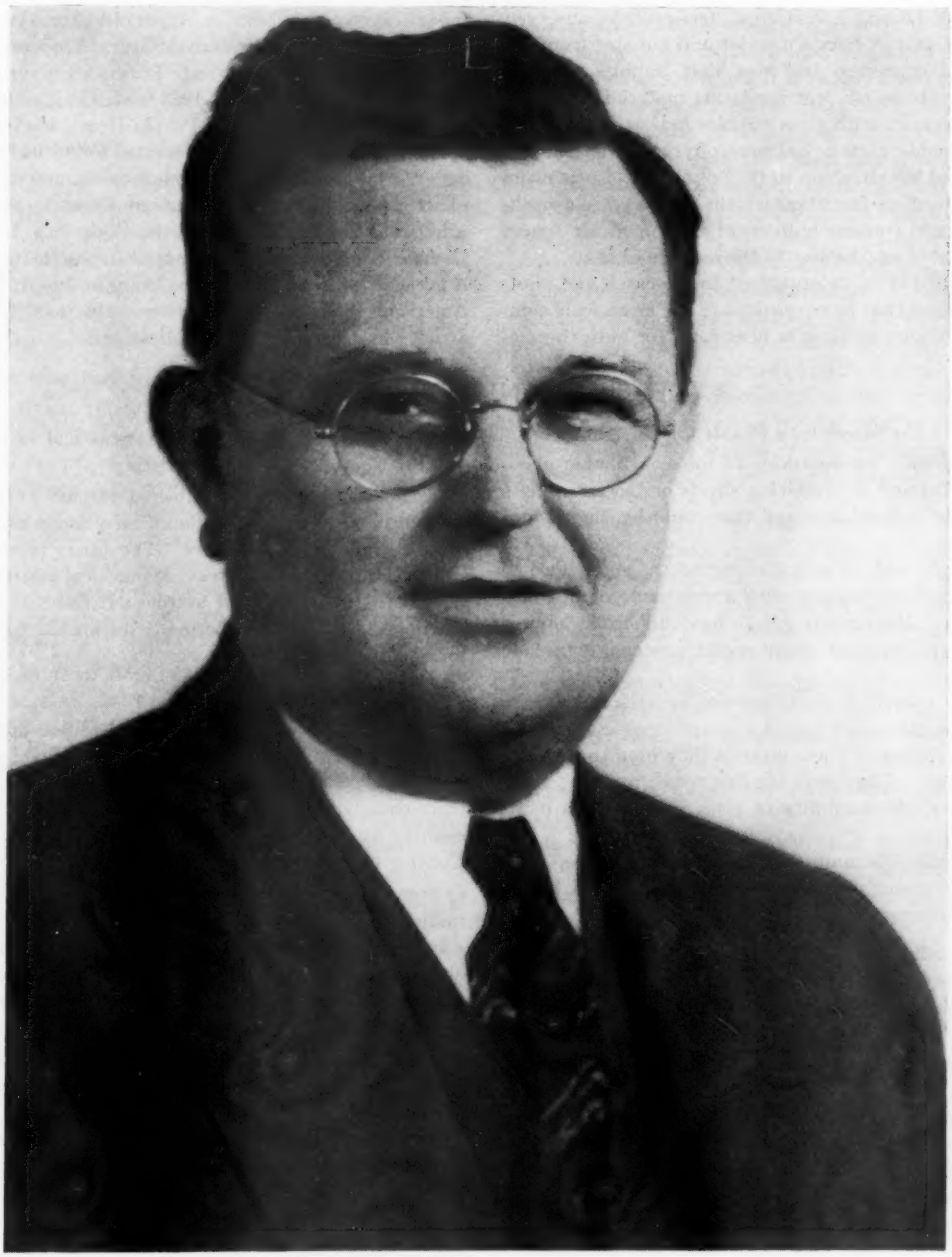

GAMES SLAYTER

GAMES SLAYTER AND FIBERGLAS

Games Slayter, vice-president in charge of research and development of the Owens-Corning Fiberglas Corporation, was named a Modern Pioneer by the National Association of Manufacturers in 1940 and is a recipient of the Edward Longstreth Medal of the Franklin Institute.

A graduate of Purdue University, Lafayette, Indiana, he became interested in problems of thermal insulation while employed as a salesman of warm-air furnaces in the early 1920's. During a visit to a steel mill, he observed the effects of contact between water and hot slag from the furnaces and conceived the idea that bubbles of glass would constitute an efficient insulating material.

When experience with glass bubbles indicated that such a material would not have sufficient physical strength, Mr. Slayter turned his attention to the possibility of producing glass in the form of fine fibers which, interlaced in a resilient mass, would contain millions of entrapped air spaces that would serve as a barrier to the passage of heat.

In the early 1930's, he organized the research and pilot-plant operations that have resulted in the large-scale commercial production of glass in fiber form for both thermal insulation and air filtration. A few years later, he organized research and pilot-plant operations that have resulted in the production of glass textiles, now widely used for electrical insulation and as industrial service fabrics.

Research in the development of plastics reinforced with Fiberglas, conducted for the Army Air Forces in the Fiberglas Corporation laboratories at Newark, Ohio, has been under his direction.

Mr. Slayter was born in Argos, Indiana, December 9, 1896. He attended Western Military Academy in Alton, Illinois, before enrolling at Purdue University, from which he was graduated in 1921 with a degree in chemical engineering. He holds the Purple Heart, having received wounds in action with the American forces in France during World War I. He belongs to numerous technical societies, including The American Ceramic Society, the American Chemical Society, the American Institute of Chemical Engineers, the Industrial Research Institute, the American Physical Society, the Franklin Institute, and the American Institute of Physics. He has contributed articles to many technical publications.

DEVELOPMENT OF FIBERGLAS

The Search for a Pliable Glass

Men have tried for centuries to make a pliable glass. They first dreamed of producing sheets or blocks of glass that would be unbreakable and that could be shaped into desired forms.

A Roman is said to have discovered the secret and to have presented his emperor with a vase made of this new kind of glass. His reward was to have his head chopped off so that the emperor alone might possess so rare an object.

This story may be legend, but the Venetians did learn how to draw glass into hairlike strands possessing some degree of flexibility. These strands they used to decorate their glassware. They were the first to realize that, as the physicists say, the flexibility of glass is a function of its diameter.

Venetian glass became famous all over Europe. The secrets of its manufacture were jealously guarded by the Venetian craftsmen.

Glass Warp, Silk Fill

In 1893, Edward D. Libbey, of the Libbey Glass Company, succeeded in drawing from the heated ends of glass rods, coarse fibers of glass which were wound on large revolving drums. The fibers were worked together with silk threads into a fabric that was made into lampshades. The lampshades were shown at the Columbian Exposition in Chicago.

There a celebrated actress saw them and arranged to have a dress made of the same fabric. So fascinating was the idea of a glass dress that Princess Eulalie of Spain determined that she, too, must have one. Her glass dress is said to have been valued at $30,000.

But these fibers of glass were not sufficiently flexible. Nor was the fabric entirely of glass. Glass was the warp, silk the fill. The fabric was of no practical value, since it could not be folded without splitting.

In the early 1900's, a number of patents were issued in Germany, and some in England, on various processes for drawing finer fibers of glass. The fibers produced were still too coarse for use in weaving practical fabrics, but they were used to some extent as thermal (heat and cold) insulation, particularly in Germany during the period of the First World War.

Owens-Illinois and Corning

The real start toward what today is called Fiberglas was made in 1931. In that year, research aimed at the development of processes for producing more pliable and more commercially useful glass fibers was initiated in this country by the Owens-Illinois Glass Company and by the Corning Glass Works.

From 1931 to 1938, Owens-Illinois and Corning spent millions of dollars on the experimental and development work required to create the manufacturing processes and acquire the knowledge needed not only to produce glass in commercially useful fiber form but to make practical its production on a commercial scale.

Owens-Illinois, with its headquarters in Toledo, Ohio, carried on its research in Newark, Ohio. Corning worked separately on glass formulas and related problems in laboratories and a pilot plant at Corning, New York. Rapid progress was made, both in improved manufacturing processes and in developing markets.

Relatively coarse glass fibers, coated with an adhesive, proved their value as an air filter. In the field of thermal insulation, finer glass fibers—Fiberglas in wool-like form—made steady gains. Still finer and stronger fibers were produced, and by 1936 it was possible to manufacture

fibers pliable enough to be woven into all-glass fabrics that could be creased and folded.

With this milestone of progress reached and passed, new uses and new markets in the fields of electrical insulation and decorative fabrics were developed in quick succession.

Formation of Fiberglas Corporation

Late in 1938, the Owens-Corning Fiberglas Corporation was formed to continue the manufacture of glass-fiber materials, to carry on further research, to explore additional new uses, and to adapt the materials to still other uses which their inherent properties make them uniquely qualified to serve.

The new company acquired all the assets that Owens-Illinois and Corning had devoted to the development and manufacture of Fiberglas,* and the two latter companies accepted stock of the new company in exchange.

Fiberglas Research

Fiberglas was born of industrial research. From the time of its birth, research has been depended upon to make it possible to produce finer and stronger fibers, to develop new uses for Fiberglas materials, to adapt the materials to meet needs that cannot be adequately met by other materials, and, finally, to produce progressively better materials that can be sold at progressively lower prices.

Design Own Machines

One important phase of Fiberglas research has been directed toward the design and constant improvement of the machines required to make glass fibers. Many manufacturers can buy all, or practically all, their machines ready made; or they can have them made by outside plants. The Fiberglas Corporation cannot, and never could.

Until they were invented by Fiberglas engineers, no such machines had ever existed. The Fiberglas organization had to design them, build them, improve them, rebuild them, and improve them again. The process still continues. Fiberglas still designs, builds, and improves its fiber-forming machines.

Surface Expansion

For a great many years, many people have known how to make good glass, but not glass of a kind that can be produced in the form of strong, durable, and almost infinitely fine fibers. To mention only one factor, expansion of surface area presented a problem that only skilled and patient research could solve.

Because glass does not rust and is able to withstand surface attacks of many acids and mild alkalis without any apparent harm, most people assume that, aside from breakage, glass is practically indestructible. But the glass chemist knows that some glasses are more durable than others and that surface attacks do have an effect on most commercial grades of glass. The greater the surface area, the greater is the opportunity for these attacks to occur.

When a given mass of glass is drawn into fine fibers, its surface area is increased many times. For this and other reasons, it is necessary to develop special glass formulas as one step toward providing the fine glass fibers with resistance to weathering, chemical action, and other influences to which they will be exposed. No single formula will solve the problem, as the properties the fibers must possess differ with the uses in which they will be employed.

Other Laboratories Aid

Fiberglas research is not confined to the company's own laboratories. Many problems involved in the development and testing of materials are regularly referred to independent testing and university laboratories to bring fresh viewpoints to bear. The laboratories of other manufacturers, too, have done a superb job in adapting Fiberglas materials to their particular needs, thus constantly broadening their fields of use.

Today all Fiberglas research is devoted to increasing the output of materials for the armed forces and to developing Fiberglas materials which it is believed will aid the Army and Navy in solving problems imposed by the demands of total war. Fibers have been produced experimentally that show tensile strengths exceeding 1,000,000 pounds per square inch. Experimental fabrics have been produced that will stand temperatures of nearly 2000°F.

Manufacturing Processes

The first step in the manufacture of Fiberglas is the selection, mixing, and melting of the raw materials—selected sands, limestone, and other mineral ingredients.

By varying the ingredients and their proportions—that is, by employing the right formula—by close temperature control, and by controlling the diameter of the fibers, the fibers are given the special properties they must have to perform the service for which they are designed.

Two Basic Types

There are two basic types of Fiberglas fibers: (1) fibers which are interlaced in a resilient wool-like mass for fabrication into bats, blankets, boards, and other forms and (2) fibers which are twisted and plied into yarns which, in turn, are woven into braids, tapes, and cloths.

In manufacturing the first type of fibers, the raw materials are melted and refined in large furnaces holding 40 tons or more. The molten glass flows from the furnaces in thin streams. Jets of high-pressure steam hit these streams of glass with terrific force and yank them into threadlike fibers.

The fibers fall upon a conveyer belt in a fleecy, resilient mass. For some thermal-insulation applications, Fiberglas is used in this form. For other thermal applications, it may be treated with a binder, compressed, and shaped into rigid or semirigid boards.

Two Textile Processes

In the manufacture of the textile fibers, two processes are employed, the continuous-filament process and the staple-fiber process. Both processes require that the raw materials be melted and refined and that the glass then be molded into marbles about five-eighths of an inch in diameter.

The marbles are carefully inspected for impurities that might affect the tensile strength or other properties of the fibers. Those that pass the inspection are remelted in small electric furnaces, each of which has many small holes in the base of the melting chamber through which the molten glass flows in fine streams, or filaments.

* T. M. Reg. U. S. Pat. Off.

Continuous-Filament Process

In the continuous-filament process, more than 100 filaments are drawn simultaneously and gathered into a strand. The strand is attached to a high-speed winder that, as it draws the strand, attenuates each stream of glass where it emerges from the furnace, reducing its diameter to a fraction of the diameter of the hole through which it emerges.

From a single marble, 97 miles of a single filament can be drawn. The length of the continuous-filament strands is limited only by packaging requirements. The strands could be drawn to indefinite lengths, running to thousands of miles.

Staple-Fiber Process

In the staple-fiber process, the molten glass also flows in thin streams through small holes in the base of the furnace and is struck by jets of high-pressure air or steam which yank the glass into fibers varying in length from 8 to 15 inches, much greater than the length of the best long-staple cotton.

The fibers are driven down onto a revolving drum on which they form a veil resembling a cobweb. The gossamer web of fibers is gathered from the drum and wound on a tube in the form of a sliver (pronounced slyver), an untwisted soft yarn.

Strands of either continuous-filament or staple fibers are twisted and plied on textile machinery into yarns from which Fiberglas fabrics are woven. Fabrics woven of continuous-filament yarns are thin, smooth, and lustrous. Fabrics woven of staple yarns have a slightly fuzzy appearance and are less lustrous.

The Properties of Fiberglas

Flexibility is the distinguishing property of Fiberglas which everyone can feel and see. Fiberglas is flexible for just one reason. The fibers are almost incredibly thin in relation to their length.

Steel is rigid in a thick, short piece, but heat it and draw it out into a fine wire and it becomes extremely flexible. The same is true of glass.

Fiberglas textile fibers are so thin that they are almost invisible. From one hundred to several hundred fibers, or filaments, are gathered together to form even a fine strand. When such a strand is folded or knotted it is unlikely that any single fiber will be bent more sharply than it can tolerate without breaking.

But flexibility is far from being the whole story. Incombustibility is another property of Fiberglas that anyone can test for himself. Light a match to a strand of Fiberglas fibers and it will not flame up, or even smolder.

The fibers may sinter or melt, and the match flame will leave a black deposit of carbon, but the material will not burn, nor will it give off smoke or any noxious gas. In textiles, fire safety is a rare quality. It opens up to Fiberglas many fields that other materials cannot enter.

Highest Strength-Weight Ratio

Steel is the material usually chosen as the symbol of strength, but Fiberglas fibers possess the greatest tensile strength-weight ratio of any commercial material either occurring in nature or synthesized by man. Fibers averaging 23 one-hundred-thousandths of an inch in diameter have a tensile strength of more than 250,000 pounds per square inch.

No Shrinkage or Stretch

Glass fibers, even though as fine as gossamer, are still neither more nor less than microscopically tiny glass rods. Because they have no cellular interstructure, they cannot absorb moisture. Their surfaces can be wet, but moisture cannot get into the individual fibers.

Moisture, therefore, will not cause the fibers to shrink, stretch, or swell. They will not rust, rot, or mildew. They are unaffected by most acids. When used with suitable varnishes and skillfully applied by electrical design engineers, they offer high resistance to the flow of electric current.

Light as Aluminum

Solid glass is as light in weight as cast aluminum. A cubic foot of glass in the wool-fiber form is approximately one hundred times lighter than a cubic foot of solid glass. Fiberglas insulating wool weighs only one and a half pounds per cubic foot and is actually 99 per cent air and 1 per cent glass.

This light weight, combined with resiliency in the wool-like forms, gives great thermal-insulating value per pound of glass. The textile fibers not only have great strength in proportion to weight, but occupy little space in proportion to strength, weight, or electrical-insulation value.

It is the combination of all these properties in one basic material that makes it possible for Fiberglas to better perform many services than any other one material. This advantage has also made it possible for Fiberglas to adequately replace certain materials now critically scarce because of vital war uses.

The Flow of Heat

The word "insulation" does not in itself call up a picture of the complex problems involved in controlling the flow of heat, whether in the home, aboard ship, on a plane, or in an industrial plant.

No better illustration of the complexity of these problems can be found than is provided by the conditions encountered in the low-temperature installations used for the preservation of perishable foods, the cold-processing of many war materials, and the testing of military equipment. Here the outside temperature may be from 100° to 120°F., whereas the temperature in the cold compartment may be far below zero.

Wherever a temperature differential exists, Nature makes every effort to destroy it by causing the heat to flow toward the cold until inside and outside temperatures are the same.

But Nature does not rest content with this. Where there are large temperature differentials there is usually also a great difference in the amount of water vapor in the warm and cold air. The warmer the air, the greater its moisture capacity.

Just as heat always tries to flow toward cold, so heavy concentrations of moisture try to dilute themselves in the colder air that contains less moisture. Thus Nature tries to force both heat and moisture through the insulation barrier into the cold compartment or through the wall of a heated home to the cold outside atmosphere.

If the attempt succeeds, and moisture enters the insulation through the warm side, but is unable to get out through the cold side, it overloads the air near the cold surface and condenses into water. I this happens, the effectiveness of the insulation is impaired, because water is an excellent conductor of heat.

Further, when the vapor condenses on a surface that has a temperature below 32°F., it freezes, swells, and may even exert enough force to break down the construction that contains the insulation.

Engineers know how to retard the flow of moisture into insulation from the warm side and how to prevent condensation by allowing moisture to escape through the cold side, but it is not always possible to provide sufficient safeguards against the forces of Nature. Heat and moisture vapor, for instance, will flow through materials that will stop the flow of air or water.

The degree to which the insulation material is able to withstand such destructive moisture conditions, while retarding the flow of heat from the warm to the cold surface, is the test of its efficiency.

Fiberglas Meets Test

When glass fibers are interlaced to form a resilient, woollike mass, or when the fibers are treated with a binder and compressed into boards, millions of air spaces are entrapped. These air spaces retard the flow of heat. Where the fine, cylindrical fibers cross and touch each other they have exceedingly small contact points. Heat, therefore, cannot pass readily from one fiber to another.

Add to this the fact that the individual fibers will not burn, that they will not absorb moisture, that if they become wet they will not rot or mildew, that they will not settle under vibration, that individually and in the mass they are extremely light in weight and it will be evident why Fiberglas is one of the most efficient and widely used thermal-insulating materials.

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CORNING GLASS WORKS IN CANADA

The Corning Glass Works will manufacture a complete line of glass baking ware in Canada. Operations will be broadened as rapidly as possible to cover the manufacture of other types of glassware. Heretofore, Corning has supplied Canada with these products from its American plants.

This is Corning Glass Works' third move in the foreign field during the past two years. In 1943 the Company purchased an interest in Cristalerias Rigolleau, Argentina's leading glass manufacturer, and in 1944 acquired an interest in Brazil's foremost glass company, Vidraria Santa Marina of São Paulo.

The operations of the Canadian plant will be handled through a wholly owned subsidiary to be established for this purpose. The new plant, purchased from the Dominion Government, is a portion of the plant formerly managed by Research Enterprises, Ltd., at Leaside, Ontario, Canada.

Inasmuch as the plant was not designed for glass manufacturing, extensive reconversion work will be necessary to adapt facilities for such a purpose. Production of baking ware is not expected until the spring of 1946 at the earliest and may even be delayed beyond that date if unforeseen war developments should necessitate the continued use of the plant for war purposes.

GLASS CONTAINER INSTITUTE SETUP APPROVED

On May 15 the United States District Court in Toledo, Ohio, Judge Frank Kloeb presiding, entered an order permitting the four glass container manufacturers who were defendants in the recent antimonopoly trials to cooperate within certain limits with the newly formed Glass Container Manufacturers' Institute.

This decree allows the so-called defendant glass companies, viz., the Owens-Illinois Glass Company, the Hazel-Atlas Glass Company, the Ball Brothers Company, and the Thatcher Manufacturing Company, to cooperate with the Standing Committees of the Institute.

Regular membership in the Institute is open to all nondefendant glass container manufacturers and manufacturers of closures as well as suppliers. The defendant glass manufacturers have been granted "nonmember" status with no voting power or control in the administrative affairs of the Institute but will be represented in the activities of the nine Standing Committees by one of their own employees technically skilled in the particular field of each Committee.

From a functional standpoint, the Institute has nine Standing Committees, the channels of cooperation between the nonmember glass companies and the Institute's regular membership. These are Committee on Market Research and Promotion, Traffic Committee, Committee on Government-Industry Relations, Committee on Labor Relations, Committee on Testing Procedures, Technical Committee on Glass Packed Products, Committee on Standards for Finishes, Committee on Container Design and Specifications, and Committee on Package Design and Specifications.

YOUR PERSONAL SOCIETY

The American Ceramic Society is of, for, and by ceramic persons and corporations. For forty-six years, their sole purpose has been promoting cooperatively their ceramic welfare.

By educational and research facilities promoted by them, ceramics in America has forged to leadership.

REPORT OF COMMITTEE ON GEOLOGICAL SURVEYS*

H. RIES, *Chairman*

The last time this Committee made a report, it dealt with the definitions of different types of clay, a subject which the Committee felt needed attention.†

This time, the Committee presents a series of maps of the different states on which it has attempted to plot the more important types of clay.

A number of state geological surveys have in the past issued reports dealing with their clay (and shale) resources, but many of these are out of date, and new deposits have been developed since.

The types of clay selected include the following: (1) refractory fire clays, with P.C.E. above cone 25, (2) low heat-duty fire clays, with a P.C.E. between 19 and 25, (3) flint clays, (4) diaspore clays, (5) ball clays, (6) residual kaolins, (7) sedimentary kaolins, (8) fuller's earth, (9) bentonite, and (10) paving-brick or sewer-pipe clays.

Each of these types (except the diaspore clays) is represented by a special symbol, which has been placed on the map as near as possible to the area whose clay type it represents.

In some cases, one or two types of clay may occupy a fairly large area; in that case, its general boundaries are outlined.

In collecting the data for these maps, all available published material has been consulted, and, in addition, the various state geologists and other individuals whose names are mentioned‡ have been written to for information or advice. The assistance of these persons, cheerfully given, has been of great value to the Committee.

The Chairman also wishes to express his thanks to the members of the Committee for their hearty cooperation and assistance.

Thanks are also due to the Bureau of Agricultural Economics, U. S. Department of Agriculture, for permission to use its outline maps for plotting the clay deposits.

Even a glance at the maps will show that certain states of the Far West, such as New Mexico, Arizona, Wyoming, and Nevada, appear to have few clay deposits of commercial value. This apparent deficiency may be due to the fact that their clay deposits have not been investigated in detail.

Bentonite and fuller's earth stand out most prominently in these areas, which may be explained by the fact that these two types of clay have been quite widely sought and are sometimes shipped long distances to the market. Wyoming bentonite is an example.

The states of Maine, New Hampshire, Rhode Island, Massachusetts, Connecticut, and Louisiana are not included because they appear to contain no workable deposits of the types of clay plotted.

Accompanying the report is also a selected bibliography covering the clays shown on the maps. This is not complete for the reason that earlier reports have been omitted in those cases where there are later or more comprehensive reports.—H. RIES, *Chairman;* A. F. GREAVES-WALKER, J. E. LAMAR, NORMAN PLUMMER, O. C. RALSTON, W. M. WEIGEL, AND HEWITT WILSON

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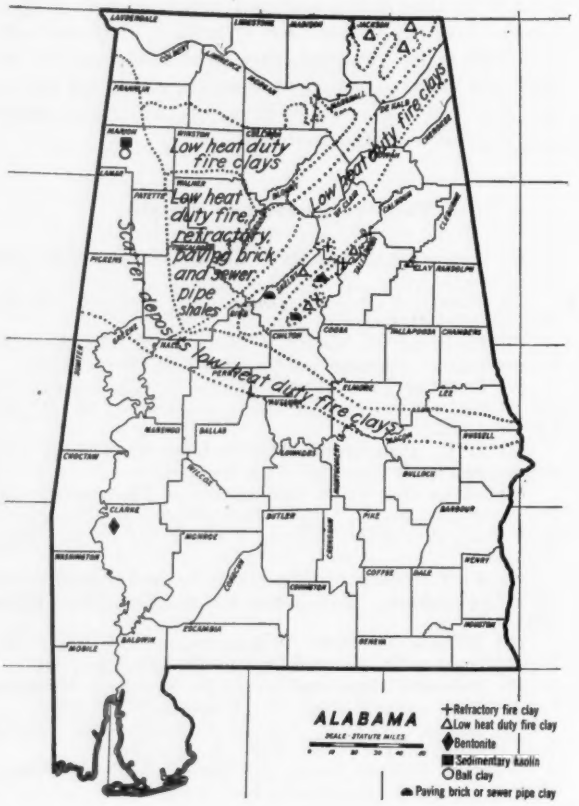
Low heat duty fire clays
Low heat duty fire clays
Low heat duty fire, refractory, paving brick and sewer pipe shales
Scattered deposits
Low heat duty fire clays
ALABAMA
SCALE · STATUTE MILES
+Refractory fire clay
△Low heat duty fire clay
◆Bentonite
■Sedimentary kaolin
○Ball clay
Paving brick or sewer pipe clay

* This report was first presented in 1943. The collecting and preparation of maps delayed publication.

† See *Bull. Amer. Ceram. Soc.*, **18** [6] 213–15 (1939).

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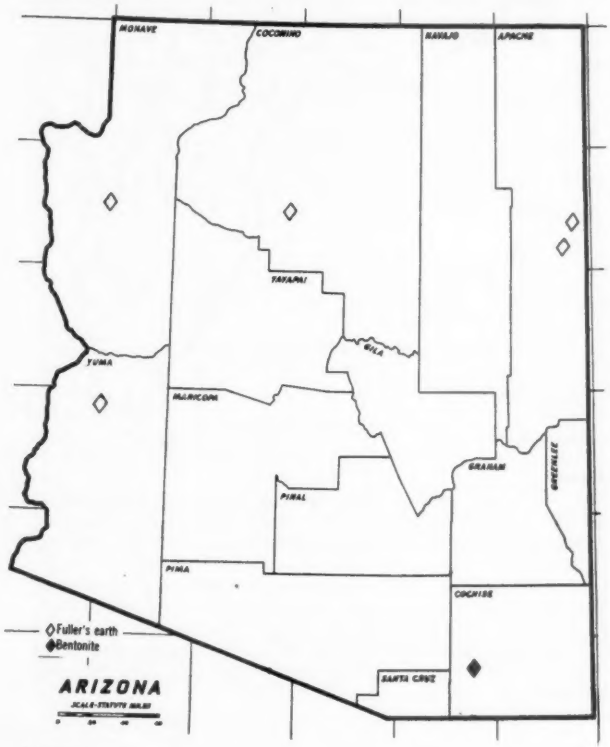

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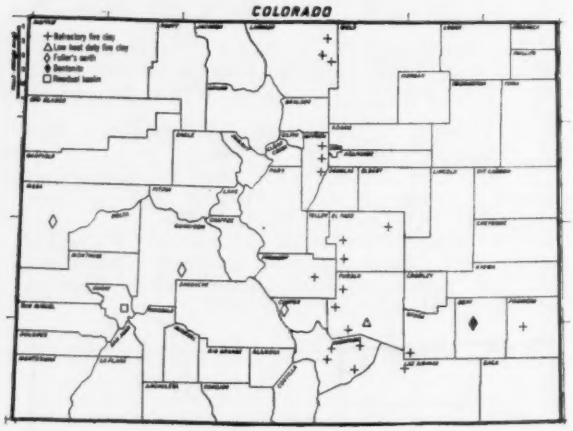

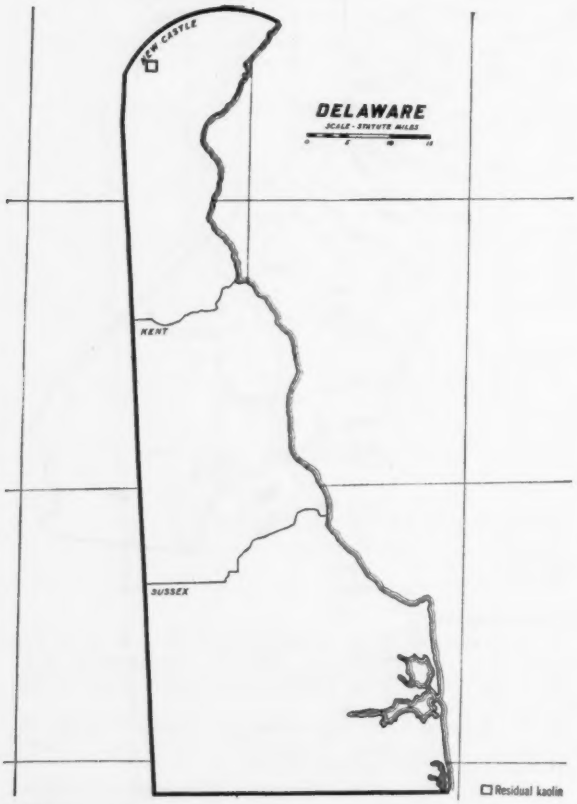

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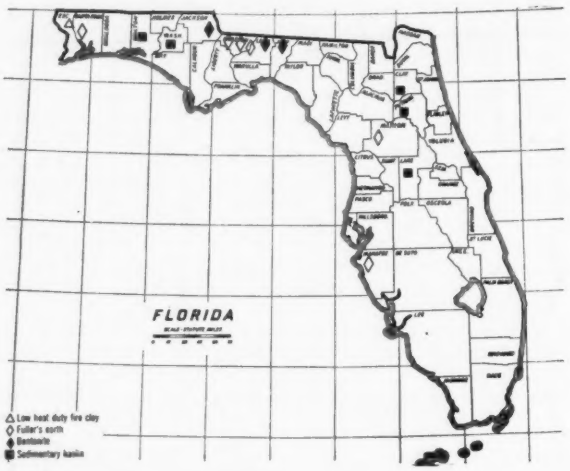

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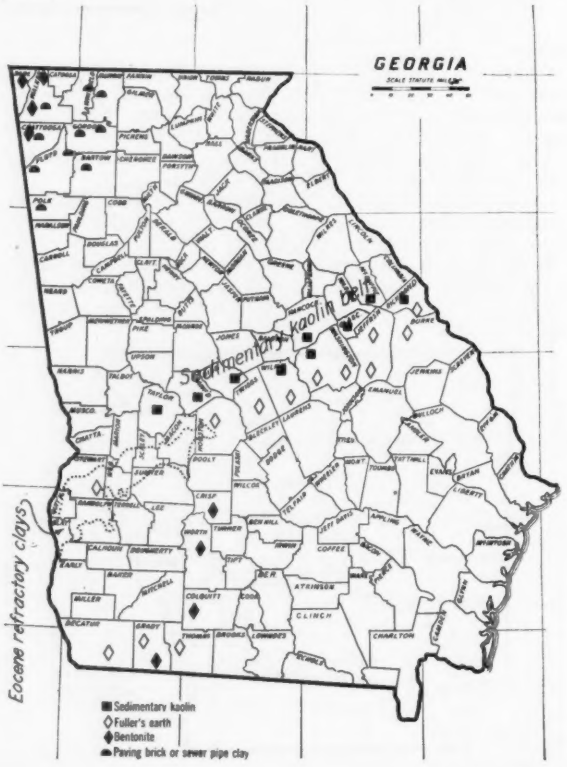

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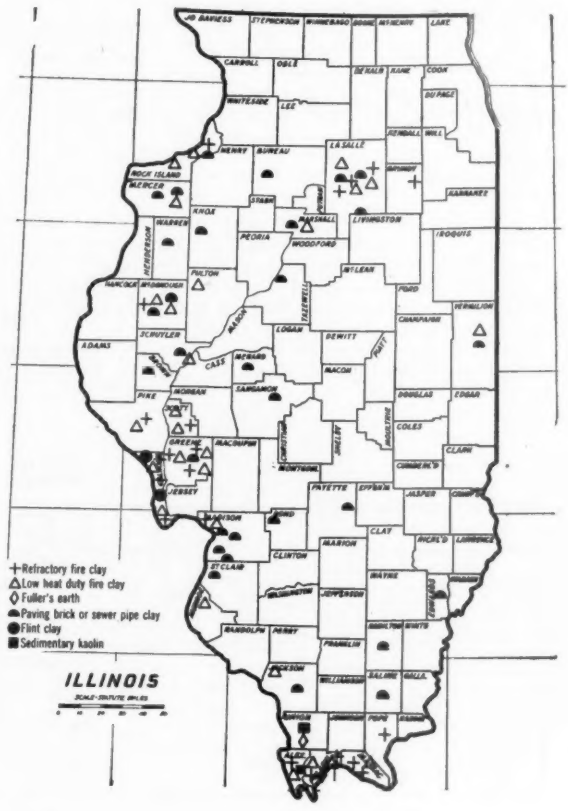

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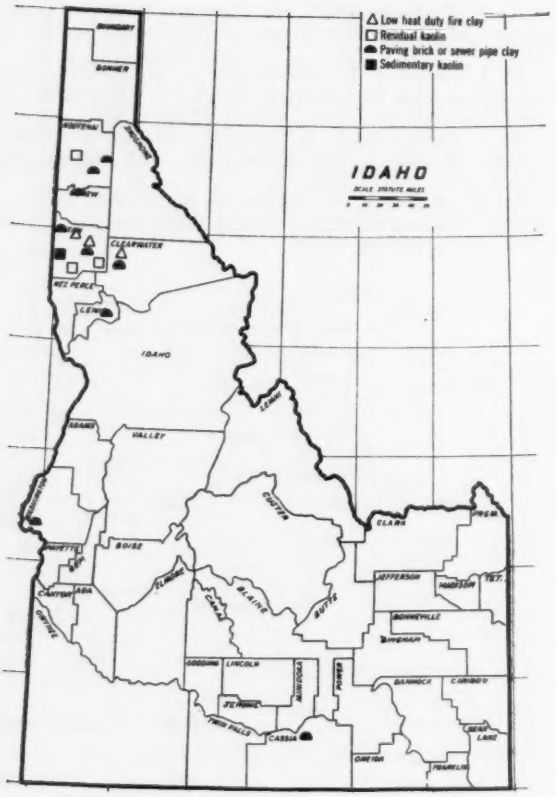

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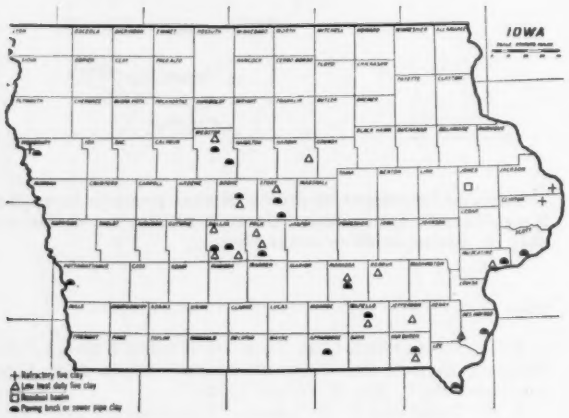

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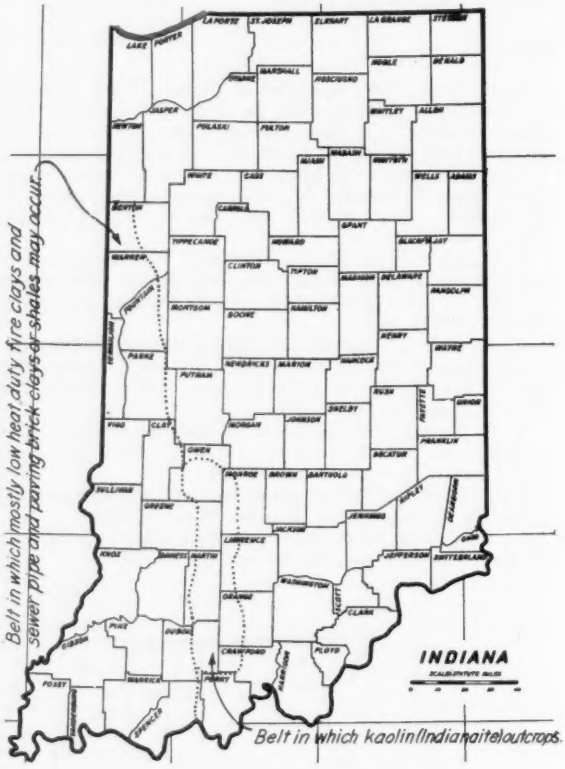
Belt in which mostly low heat duty fire clays and sewer pipe and paving brick clays or shales may occur.
INDIANA
Belt in which kaolin/Indiana/te/outcrops.

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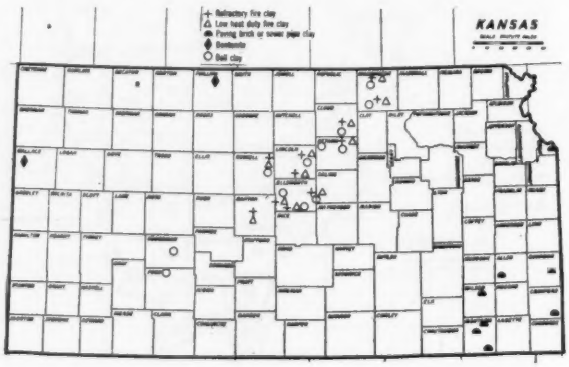

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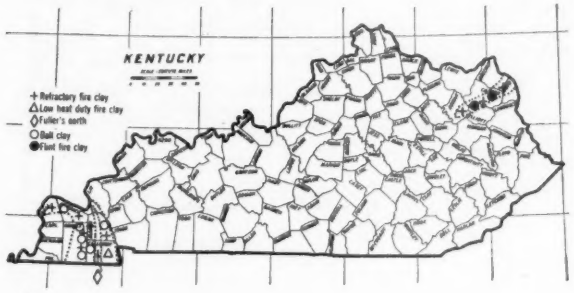

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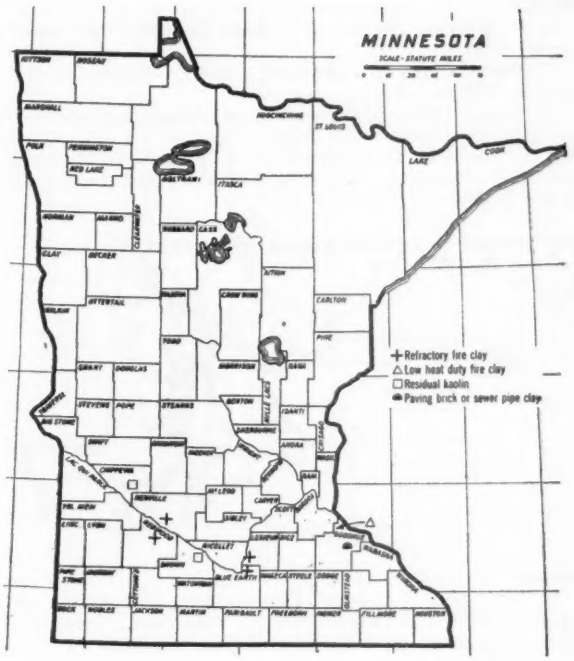

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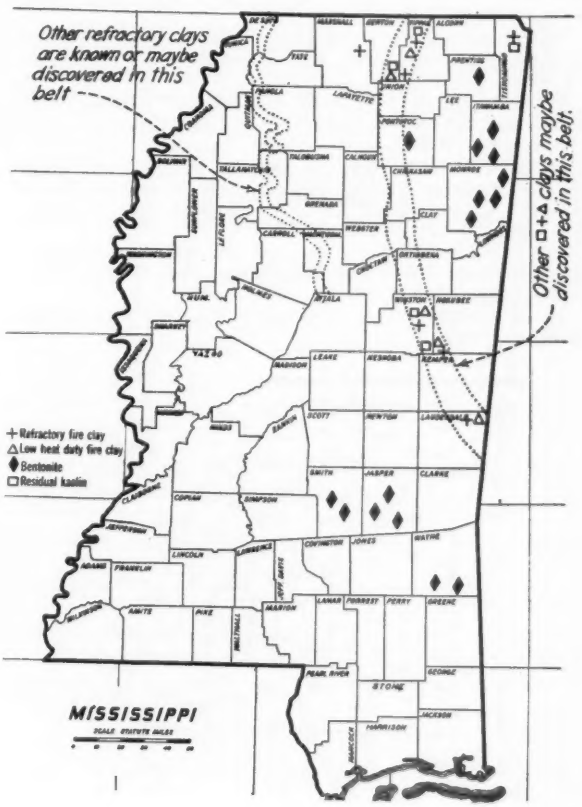
Other refractory clays are known or maybe discovered in this belt
Other □+△ clays maybe discovered in this belt.
+ Refractory fire clay
△ Low heat duty fire clay
♦ Bentonite
□ Residual kaolin
MISSISSIPPI

(1945)

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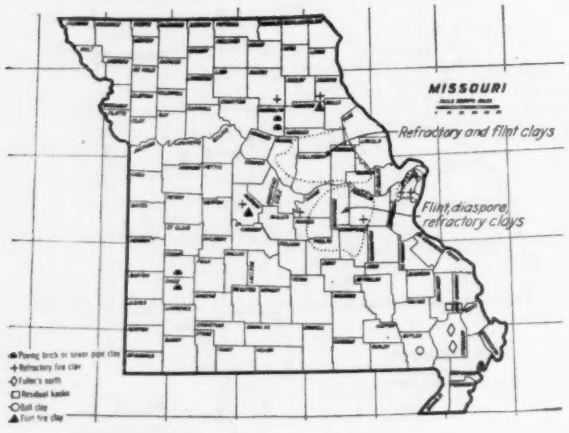

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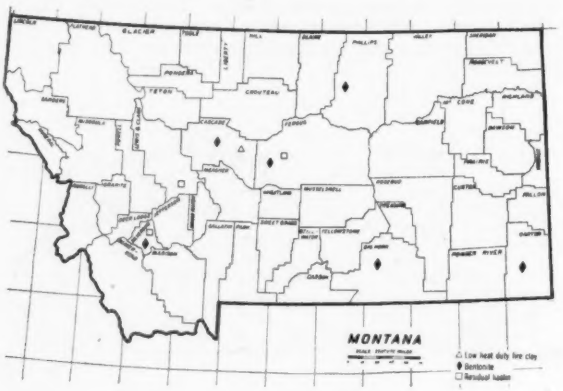

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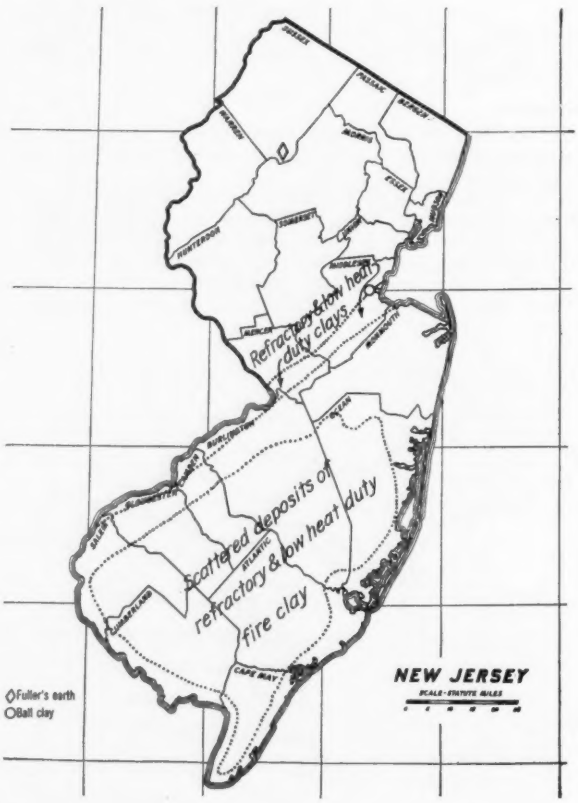
Refractory & low heat duty clays.
Scattered deposits of refractory & low heat duty fire clay
NEW JERSEY
Fuller's earth
Ball clay

Nebraska

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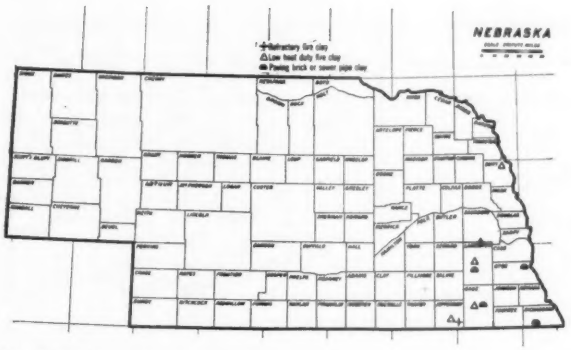

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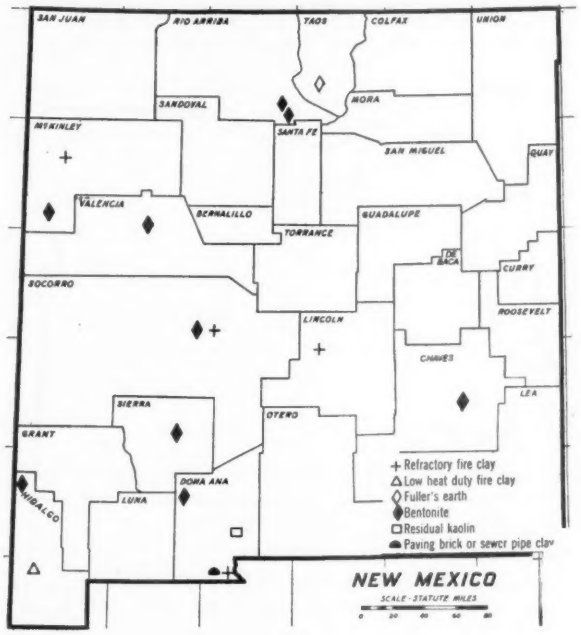

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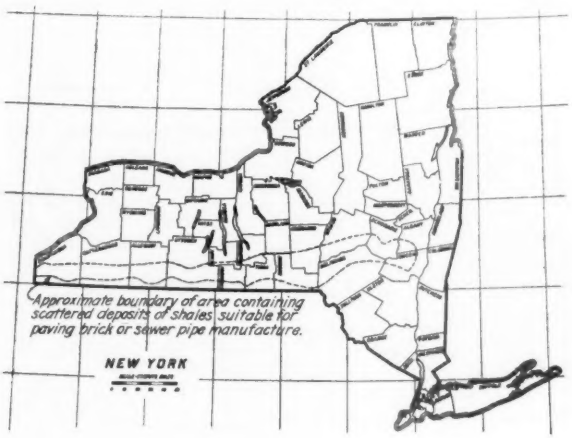
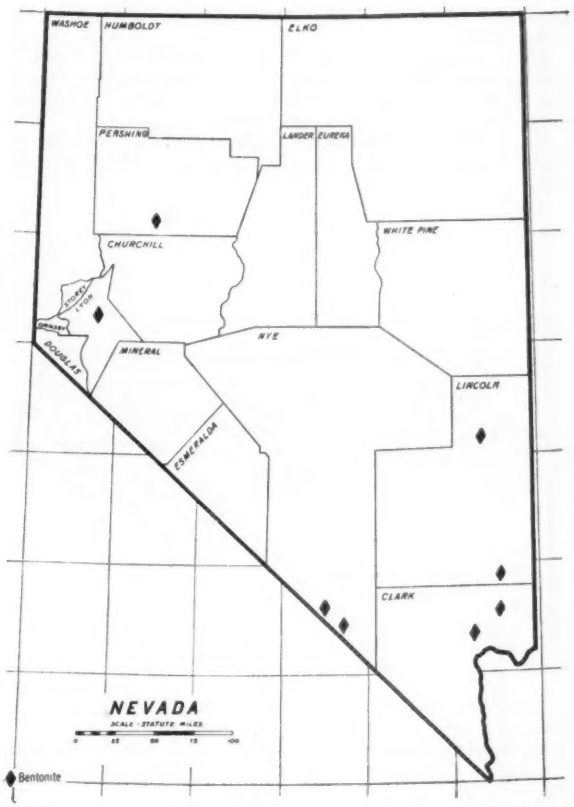

Approximate boundary of area containing scattered deposits of shales suitable for paving brick or sewer pipe manufacture.
NEW YORK

(1945)



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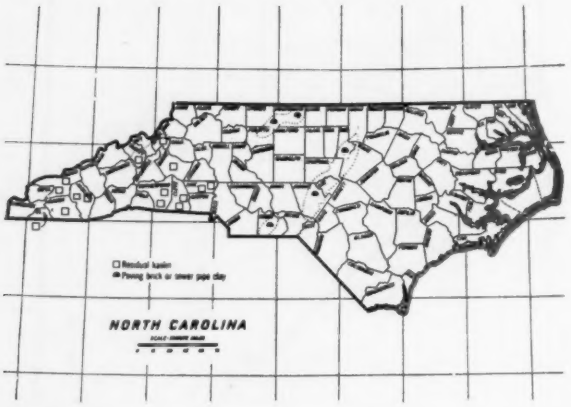

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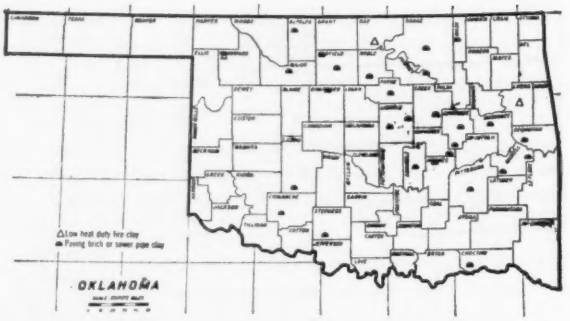

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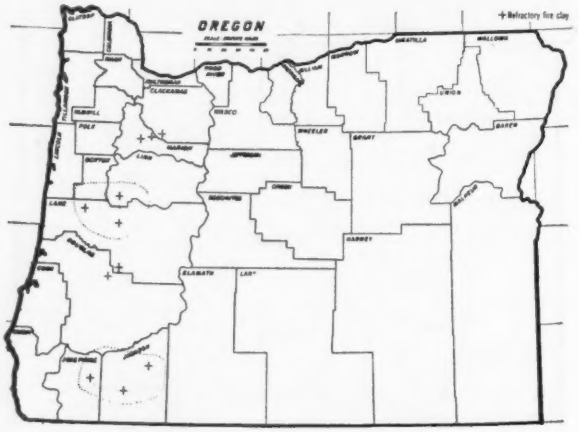

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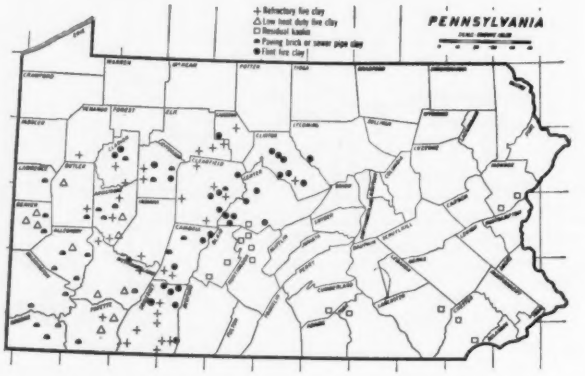

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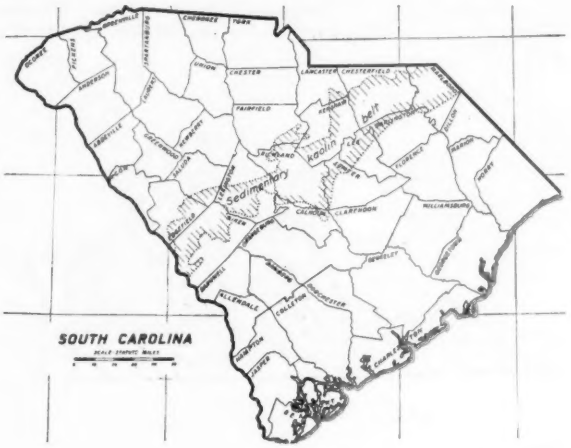

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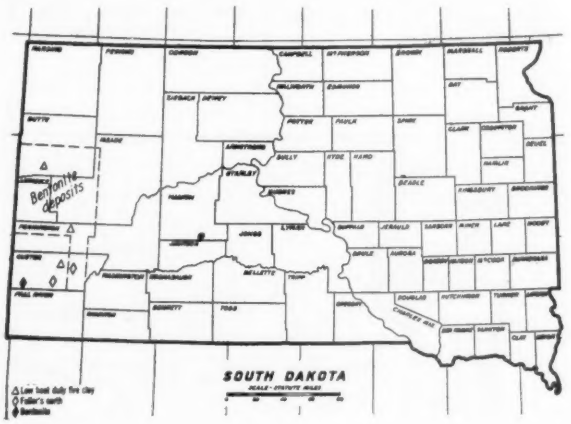

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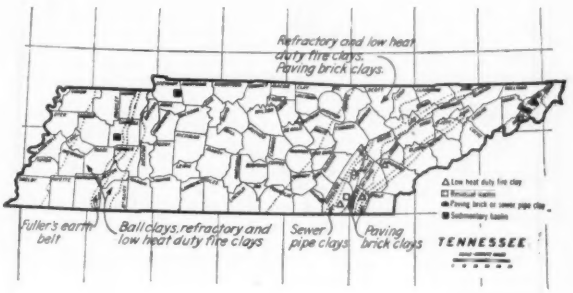
Refractory and low heat duty fire clays. Paving brick clays.
Fuller's earth belt
Ball clays, refractory and low heat duty fire clays
Sewer pipe clays
Paving brick clays
TENNESSEE

Texas

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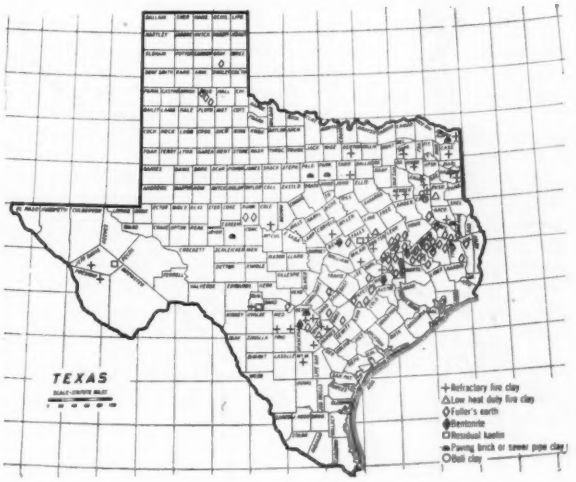

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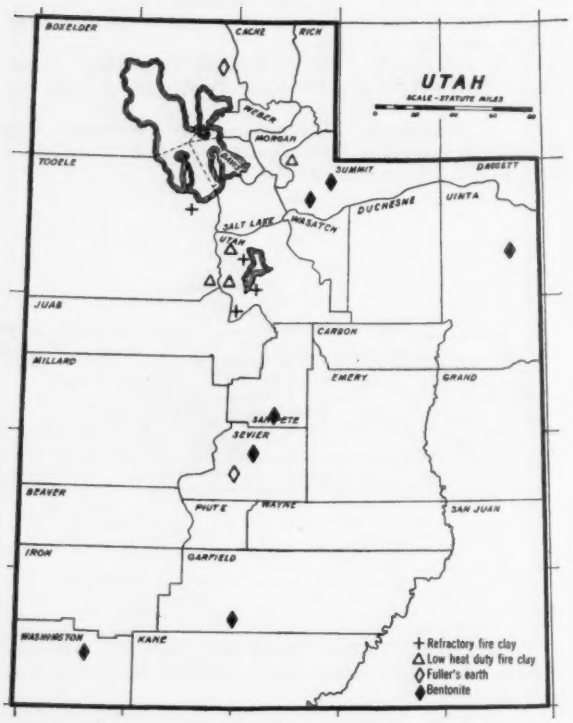

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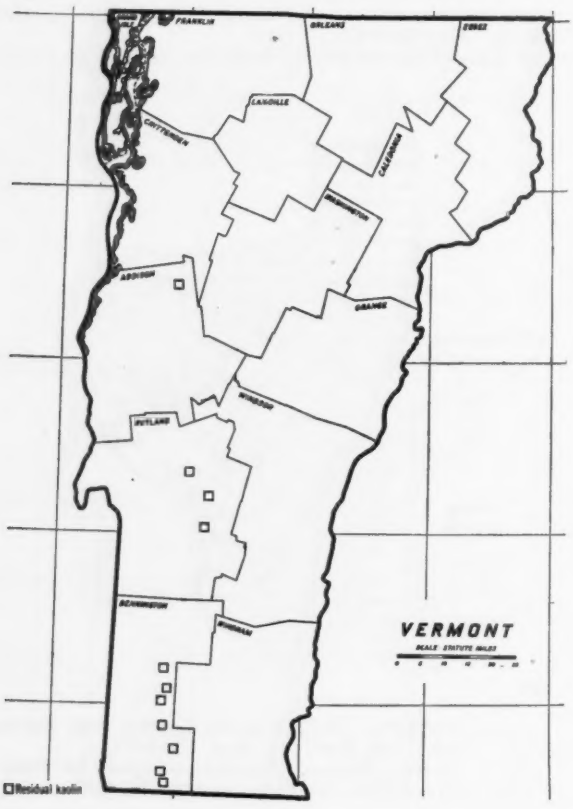

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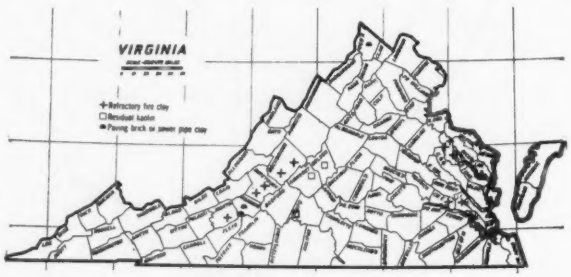

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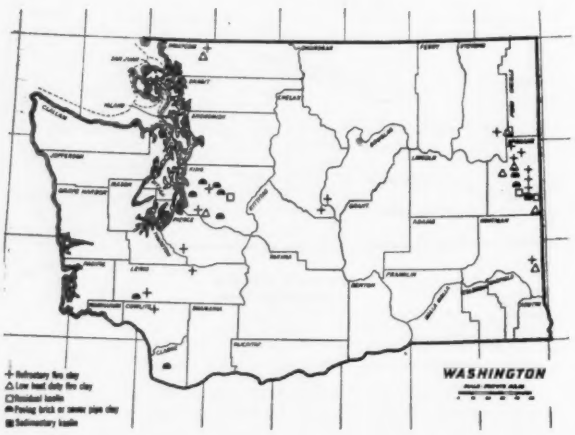
WASHINGTON
+ Refractory fire clay
△ Low heat duty fire clay
□ Residual kaolin
● Paving brick or sewer pipe clay
■ Refractory kaolin

West Virginia

S. L. Galpin, "Studies of Flint Clays and Their Associates," *Trans. Amer. Ceram. Soc.*, **14**, 301–46 (1912).

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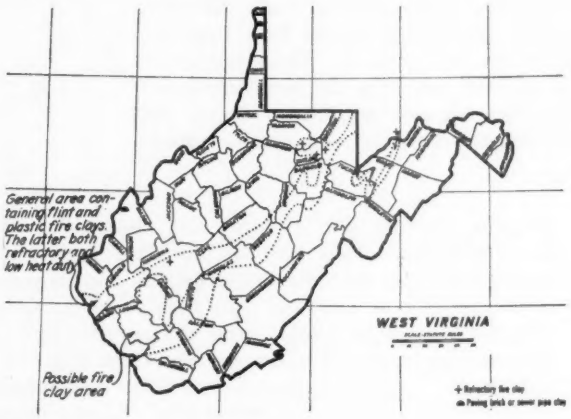
General area containing flint and plastic fire clays. The latter both refractory and low heat duty
WEST VIRGINIA
Possible fire clay area

Wisconsin

H. Ries, "Clays of Wisconsin and Their Uses," *Wis. Geol. and Nat. Hist. Survey Bull.*, No. 15 (1906).

Wyoming

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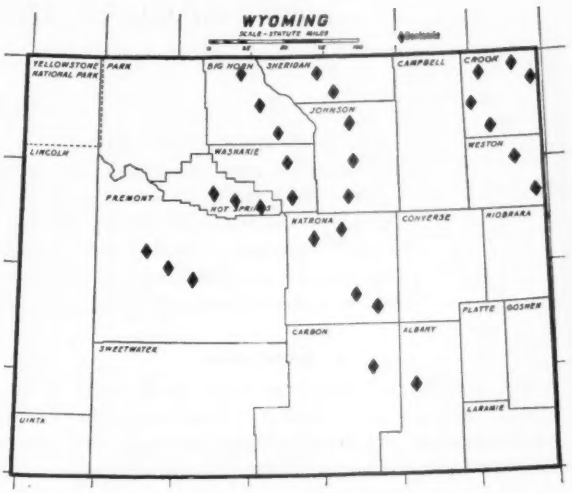

TITANIUM ALLOY ANNOUNCES AMPLE RUTILE SUPPLY

The Titanium Alloy Mfg. Co., Niagara Falls, N. Y., has announced that they have enough rutile to meet all anticipated requirements for the ceramic industry for the next six to eight years.

The supply is available to potteries manufacturing hotel ware and other products of this type, and recent shipments have been averaging thirty tons per month.

The rutile is American in source and its staining quality equals or exceeds that of prewar imported rutile.

A rutile for use in stainless frits has also been developed by Titanium. Sample quantities have been delivered, and ample quantities are available. This rutile also comes from a source in the United States.

TRIBUTE TO GORDON C. KEITH*

The Canadian Ceramic Society members have lost, in the death of Gordon C. Keith, an ardent and enthusiastic worker. During Gordon's thirty-one years as Secretary-Treasurer of the Ceramic Society, he never for a moment lost his keen interest in the work.

It has been our custom for many years to attend the Annual Meetings of The American Ceramic Society together. When gasoline was available we motored, but latterly went by train. I always enjoyed this yearly get-together when many interesting and happy hours were spent. Gordon was a life member of The American Ceramic Society and was keenly interested in its activities, and he had a wide circle of friends among its members.

Gordon was placid, agreeable, and a willing worker, and our Canadian Society has lost one of its main supports. His long service as Secretary-Treasurer gave him an acquaintance with the ceramic personnel of many industries. We shall all greatly miss Gordon, both as a personal friend and as a great worker for the general good of the ceramic industry.

The members of the Brick and Tile Manufacturers' Association of Canada extend sympathy to Mrs. Keith and her family at this time and wish to assure Connie that we will continue to give her our support in the publication of *Clay Products News*.

—William C. McGolpin, *President,*
Brick and Tile Manufacturers' Association of Canada

* Mr. Keith died April 24, 1945. The notice of his death appeared on p. 186 of the May, 1945, *Bulletin*.

SHRINKAGE OF EXTRUDED STEATITE TUBES*

By Henry H. Hausner and Angela F. Naporan

Abstract

Extruded steatite tubes shrink in a peculiar way. Sometimes the inside diameter shrinks more than the outside and in some cases the outside shrinks more than the inside. Very rarely do both diameters shrink in the same manner. The shrinkage of tubes was studied to determine whether there are laws governing the shrinkage of extruded materials. The writers conclude that the pressure distribution during the extrusion process plays a major role in the shrinkage of tubes and some pressure distribution will essentially affect their shrinkage.

I. Introduction

The problems of shrinkage have at all times been of utmost interest to ceramists. Years ago, the volume shrinkage especially was investigated, the volume shrinkage being the essential factor for the density of material and of porosity. With the use of ceramic materials of high dielectric qualities in the field of electronics, the question of linear shrinkage of these materials became more and more important. The tolerances required for high dielectric materials are now closer than ever. With the question of close tolerances, the problem of linear shrinkage has become not only more important but requires investigation.

McNamara and Major[1] investigated the effect of mold-shape pressure on firing shrinkages of a steatite body, and their experiments indicate that the shape of the mold affects the linear firing shrinkage of the various dimensions. The greater the variation in dimensions, the greater the divergence in the linear shrinkage of these dimensions. Stone[2] investigated and described methods of controlling firing shrinkage and some effects of storage conditions on the shrinkage. All of these investigations concerned dry-pressed material; apparently no detailed experiments have ever been published on the shrinkage of extruded ceramic materials. The writers, therefore, have tried to investigate the linear firing shrinkage of extruded steatite, especially of extruded steatite tubes. It is well known that these tubes shrink in a peculiar way. Sometimes the inside diameter shrinks more than the outside diameter and, in some cases, the outside diameter shrinks more than the inside diameter; very rarely do both diameters shrink in the same manner.

The following study was made to determine whether there are laws concerning the shrinkage of extruded materials and, if possible, to find these laws.

For these experiments, a typical steatite body similar in composition to the body used by McNamara and Major was prepared, but with 17% moisture, as normally used for the production of extruded steatite. A production extruding machine (Fig. 1) fitted with the nozzles and pins for production was used for these investigations.

After extrusion, the material was first air-dried at room temperature for 24 hours and then dried in the humidity drier for another 24 hours. After drying, the material was cut into lengths of approximately 1 and 0.20 inch, respectively. The cut samples were fired to complete vitrification in a commercial tunnel kiln. Measurements were then made of the diameters.

The percentage of the firing shrinkage S was calculated as follows:

$$S = \frac{D - D_1}{D} \times 100 \qquad (1)$$

Where D = pin or nozzle diam., respectively.
D_1 = inside or outside diam., respectively, of extruded material after firing.

Fig. 1.—Production extruding machine fitted with nozzles and pins.

* Forty-Seventh Annual Program, The American Ceramic Society, Inc., 1945 (White Wares Division No. 1). Received January 8, 1945.

[1] E. P. McNamara and Marjorie J. Major, "Effect of Mold Shape and Pressure on Firing Shrinkage of a Steatite Body," *Ceram. Age*, **44** [3] 91–92, 99 (1944).

[2] (*a*) R. L. Stone, "Methods of Controlling Firing Shrinkage of Dry-Pressed Steatite Bodies," *ibid.*, **43** [3] 86–90, 100–103, 113–14 (1944); *Ceram. Abs.*, **23** [10] 171 (1944).

(*b*) R. L. Stone, "Effect of Storage Conditions on Shrinkage of Dry-Pressed Steatite Bodies," *Ceram. Age*, **44** [4] 129–32 (1944); *Ceram. Abs.*, **23** [10] 171 (1944).

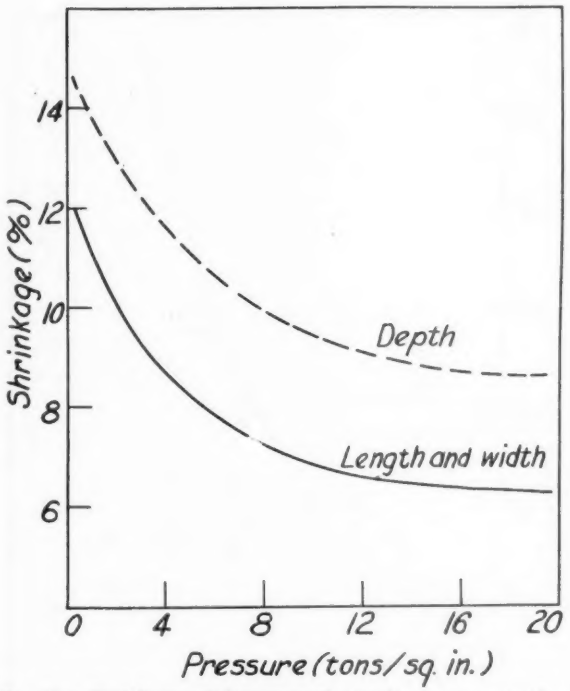

FIG. 2.—Shrinkage of dry-pressed steatite vs. compacting pressure; mold: 0.710 by 0.710 inch.

The expansion of the material immediately after extrusion was not considered. Stone[2(b)] showed that this expansion depends on the storage conditions and therefore is of lesser interest in regard to the following tests.

In general, dry-pressed or extruded ceramic material shows a maximum shrinkage in the direction of maximum compacting pressure. Figure 2 shows the shrinkage conditions of a dry-pressed piece of steatite of square shape as the function of applied pressure.[1] In dry-pressing, the maximum compacting pressure occurs in the same direction as the applied pressure (direction of movement of the piston). For extruded material, however, the shrinkage in the direction of the applied pressure is much less (approximately 40 to 50%) than the shrinkage perpendicular to this direction. In extrusion, the maximum compacting pressure is more inclined to be perpendicular than parallel to the applied pressure.

II. Extruded Bars

The first series of tests was made with extruded solid bars of seven different diameters. After firing, measurements were taken on the shrinkage of diameter and length. The results are shown in Table I and Fig. 3. The following conclusions may be drawn from the test results:

(1) The larger the diameter, the smaller the shrinkage of diameter.

(2) The shrinkage of diameter is independent of the length.

(3) The shrinkage in length is a function of the diameter; the larger the diameter, the smaller the shrinkage in length.

(4) The shrinkage in length is a function of length itself; the greater the length, the greater the shrinkage in length.

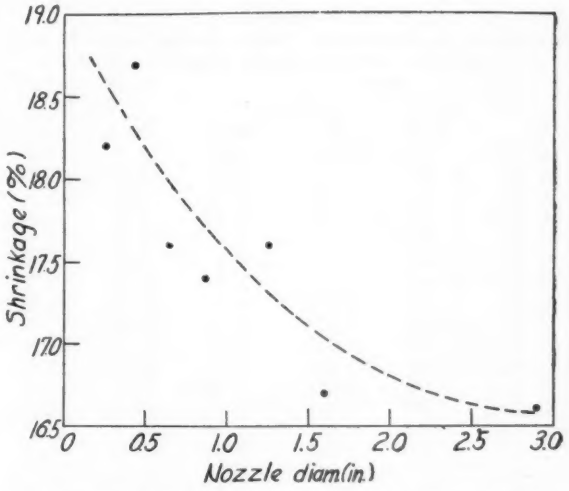

FIG. 3.—Shrinkage of diameter vs. diameter (extruded bars).

According to expectation, the shrinkage of extruded bars seems to follow strict laws which are comparatively easy to define.

TABLE I

SHRINKAGE OF EXTRUDED BARS OF DIFFERENT DIAMETERS, CUT IN PIECES OF TWO DIFFERENT LENGTHS

Nozzle diam.	Length (1.080 in.) Shrinkage (%)		Length (0.200 in.) Shrinkage (%)	
	Diam.	Length	Diam.	Length
0.260	18.2	7.9	18.2	7.5
0.425	18.7	7.7	18.7	7.4
0.635	17.6	7.7	17.6	7.4
0.857	17.4	7.5	17.4	7.3
1.240	17.6	7.6	17.3	7.5
1.610	16.7	7.5	16.3	7.2
2.900	16.6	7.4	16.6	7.3
Avg. shrinkage in length		7.63		7.37

III. Extruded Tubes

The shrinkage of extruded tubes is more complicated and apparently no laws of shrinkage for tubes have ever been published. The next tests, therefore, were made with extruded tubes.

For these five test-series, five different pins were used (keeping the inside diameter of the tubes in each of the test-series constant) and three to five different nozzles were used for each series so that each series consisted of three to five tubes with the same inside but different outside diameters. Twenty-one different tubes were made in this way and tested after firing. The extrusion process was the same as previously described. Table II shows the dimensions of nozzles and pins and the percentage of firing shrinkage of the outside and inside diameters of the 21 different test samples. It was extremely difficult to draw conclusions from Table II. Actually, no laws of shrinkage were at first apparent, but the figures in Table II became more interesting when analyzed in the form of graphs. One graph was developed for each test-series to show the shrinkage conditions of samples made with the same pin and therefore with ap-

TABLE II

SHRINKAGE OF EXTRUDED TUBES OF DIFFERENT DIAMETERS AND APPROXIMATELY 1-INCH LENGTH

No.	Diam. Nozzle (in.)	Diam. Pin (in.)	OD/ID	Shrinkage after firing (%) OD	Shrinkage after firing (%) ID
A 1b	0.178	0.046	3.8	17.9	17.9
A 2b	0.260	0.046	5.6	18.2	21.1
A 3b	0.427	0.046	8.9	18.9	21.1
A 4b	0.635	0.046	13.8	18.2	21.1
B 1b	0.260	0.171	1.52	16.6	17.8
B 2b	0.427	0.171	2.5	19.0	18.8
B 3b	0.635	0.171	3.7	18.5	19.2
B 4b	0.857	0.171	5.0	18.2	24.8
C 1b	0.427	0.316	1.35	16.7	16.2
C 2b	0.635	0.316	2.0	17.4	17.3
C 3b	0.857	0.316	2.7	17.9	18.0
C 4b	1.240	0.316	3.92	18.1	21.1
C 5b	1.610	0.316	5.1	18.0	20.6
D 1b	0.857	0.685	1.25	16.1	14.7
D 2b	1.240	0.685	1.81	17.3	16.3
D 3b	1.717	0.685	2.5	19.1	18.5
D 4b	2.610	0.685	3.8	18.8	17.1
D 5b	2.900	0.685	9.24	17.4	16.1
E 1b	1.717	1.300	1.32	16.9	15.2
E 2b	2.610	1.300	2.0	18.4	16.3
E 3b	3.625	1.300	2.79	17.6	16.5

proximately the same inside diameter. Figures 4 through 8 show the percentage of firing shrinkage of outside and inside diameters as a function of the relation OD/ID.

Figure 4 shows the shrinkage of tubes made with a pin 0.046 inch in diameter. The inside-diameter shrinkage conditions are strange. The inside-diameter shrinkage is generally much greater than the outside-diameter shrinkage, at least when the outside diameter is greater than approximately 4 × ID. At OD/ID = 4, the shrinkage of the inside and outside diameters is equal. A definite maximum of outside-diameter shrinkage can be observed when the outside diameter is approximately 10 × ID.

Figure 5 shows the shrinkage of tubes made with a pin 0.171 inch in diameter. The inside-diameter shrinkage

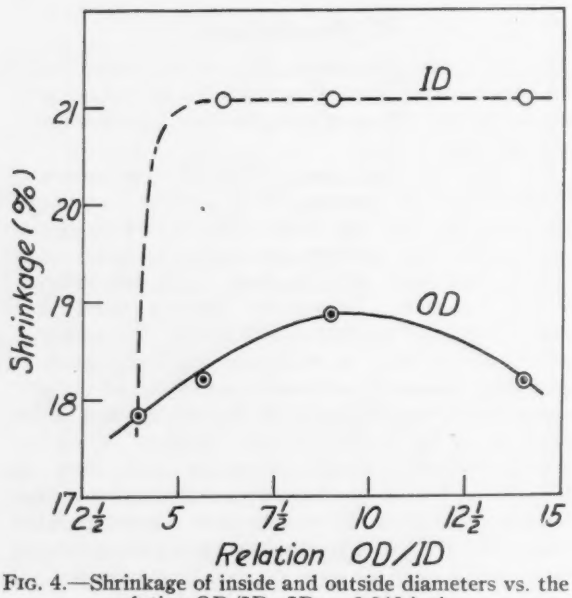

FIG. 4.—Shrinkage of inside and outside diameters vs. the relation OD/ID; ID = 0.046 inch.

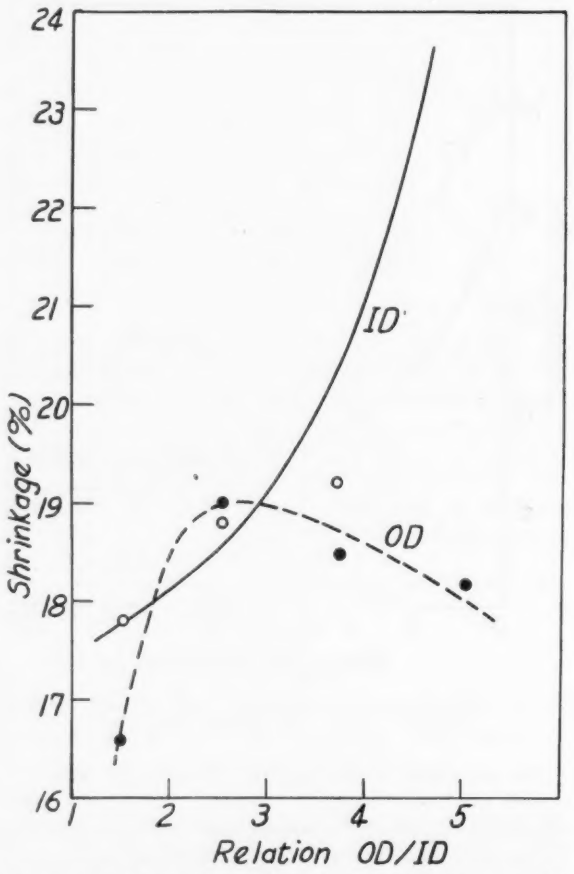

FIG. 5.—Shrinkage of outside and inside diameters vs. the relation OD/ID; ID = 0.171 inch.

is again much greater than the outside-diameter shrinkage, at least when the outside diameter is greater than approximately 3 × ID, but smaller when the outside diameter is within the range of approximately 2–3 × ID. A definite maximum of outside-diameter shrinkage can be observed when the outside diameter is approximately 3 × ID.

Figure 6 shows the shrinkage of tubes made with a pin 0.316 inch in diameter. Maxima in both inside- as well as outside-diameter shrinkage can be observed and both maxima occur when the outside diameter is approximately 4 × ID. In the range below OD = 2.5 × ID, the inside-diameter shrinkage is smaller than the outside-diameter shrinkage. When the outside diameter is greater than 2.5 × ID, the inside-diameter shrinkage is greater than the outside-diameter shrinkage, similar to the conditions shown in Figs. 4 and 5.

Figure 7 shows the shrinkage of tubes made with a pin 0.685 inch in diameter. For this inside diameter, the shrinkage conditions differ. The inside-diameter shrinkage is generally less than the outside-diameter shrinkage over the whole range and independent of the relation OD/ID. The differences in shrinkage of outside and inside diameters are approximately ½ to 1½%. Both curves again show maxima when the outside diameter is approximately 3 × ID.

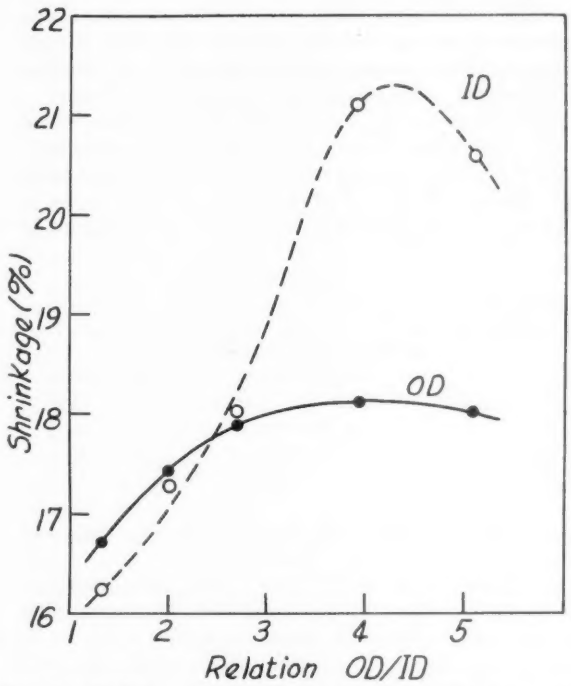

FIG. 6.—Shrinkage of outside and inside diameters vs. the relation OD/ID; ID = 0.316 inch.

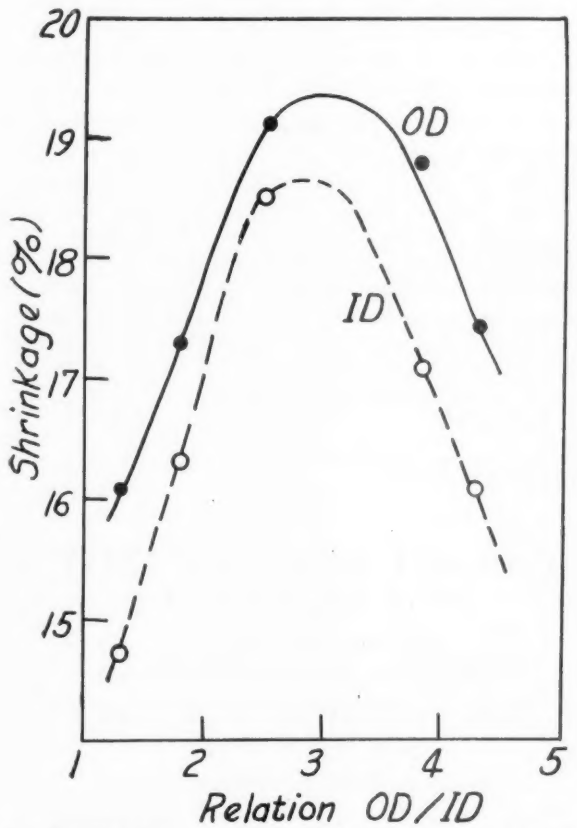

FIG. 7.—Shrinkage of outside and inside diameters vs. the relation OD/ID; ID = 0.685 inch.

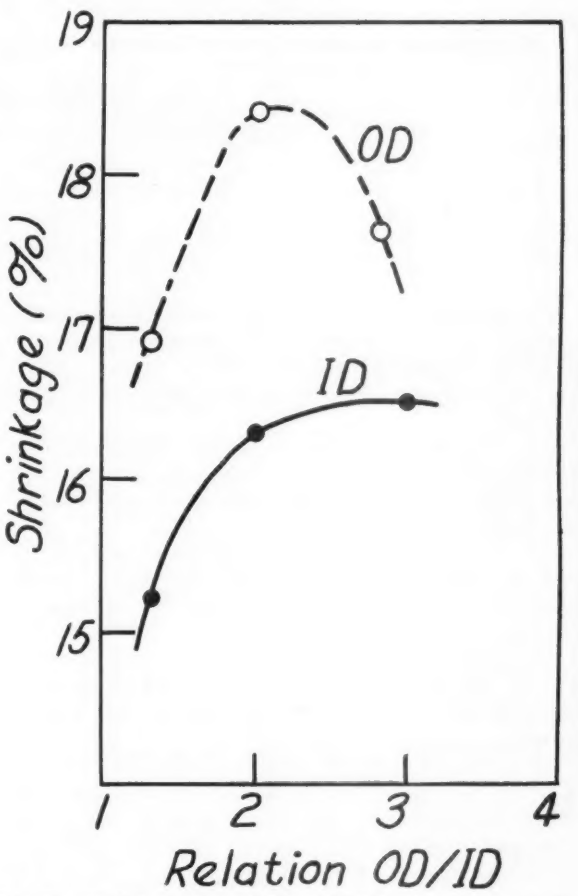

FIG. 8.—Shrinkage of outside and inside diameters vs. the relation OD/ID; ID = 1.300 inch.

Figure 8 shows the shrinkage of tubes made with a pin 1.300 inch in diameter. The inside-diameter shrinkage is again smaller than the outside-diameter shrinkage, but the difference between the two shrinkages is much greater than shown before. Both shrinkages again show maxima, but the maxima occur at different relations OD/ID.

From this analysis of Figs. 4 through 8, the following conclusions may be drawn:

(1) The shrinkage of the inside diameter undoubtedly decreases when the inside diameter increases.

(2) Tubes with small inside diameters show more shrinkage of inside than of outside diameters, especially when the outside diameter is approximately 3 × ID or greater, but less shrinkage of inside than outside diameters may be expected when the relation OD/ID is smaller than 3.

(3) A maximum shrinkage of outside diameter always occurs at a certain relation OD/ID.

(4) The maximum shrinkage of the outside diameter in a peculiar way depends upon the inside diameter and on the relation OD/ID. Table III shows four out of the five different test-series; it shows the inside diameters, the relation OD/ID where the maximum outside-diameter shrinkage occurs, and the products of the figures in column 1 times the square of the respective figures in column 2.

TABLE III

MAXIMUM SHRINKAGE OF OUTSIDE DIAMETER OF EXTRUDED TUBES

Series	Diam. of pin (in.)	Relation OD/ID where maximum OD shrinkage occurs	Approx. product ID × (OD/ID)²
A	0.046	10.5	5.07
B			
C	0.316	4	5.05
D	0.685	3	5.15
E	1.300	2	5.20

The products ID × (OD/ID)² surprisingly remain constant for the relation OD/ID where the maximum shrinkage of outside diameter occurs. In four out of five test-series, the constancy of these products could be observed.

(5) The figures of the maximum outside-diameter shrinkages in all five test-series range closely between 18.2 and 19.4%, independent of the inside or outside diameters of the extruded tubes.

(6) Additional measurements (not shown in Table II) indicate that the shrinkage of the outside and inside diameters does not depend on the length (1 or 0.20 inch) of the tube.

All of these facts, especially the fact that the products of ID × (OD/ID)² for the maximum outside-diameter shrinkage are practically constant, indicate that laws of shrinkage exist for extruded tubes.

All of these remarkable facts are connected somehow with the distribution of compacting pressure during the extrusion process. The changes in the inside and outside diameters evidently cause entirely different conditions in the distribution of the applied pressure. It is well known that the shrinkage depends on compacting pressure,[3] and McNamara and Major[1] have already shown that in dry-pressing of steatite the pressure distribution causes remarkable differences in shrinkage. It is assumed, therefore, that the study and the exact determination of pressure distribution during the extrusion process will show the right way to determine the laws of shrinkage.

To test this theory, an additional series of tests was finally made to determine whether a different distribution of compacting pressure might cause a difference in shrinkage. This last series of tests was made in the following way: Using a nozzle 0.857 inch in diameter, several bars were extruded in the described manner and cut into pieces of approximately 1- and 0.20-inch lengths, respectively. The holes in these pieces were not made in the extruding machine but were drilled. The diameter of the drilled tubes corresponded as closely as possible with the inside diameters of several extruded tubes of the same outside diameter. The pressing conditions for all the test samples were identical. The pieces were fired in the usual way.

Table IV shows the results of shrinkage of these three tubes with drilled holes. To facilitate a comparison, Table V is added, showing the shrinkage of extruded tubes with dimensions close to those of the samples shown in Table IV. A comparison between tubes with drilled and tubes with extruded holes permits the following conclusions:

(1) Tubes with drilled holes show practically no difference in inside-diameter shrinkages, no matter what the relation OD/ID or the actual dimension of the inside diameter is. The inside-diameter shrinkage of tubes with extruded holes, however, depends largely on the relation OD/ID and on the actual inside-diameter dimensions.

(2) The outside-diameter shrinkage of tubes with drilled holes depends on the inside diameter, although to a lesser degree than that of tubes with extruded holes.

(3) These final tests show that the pressure distribution is not the sole cause for some differences in shrinkage but certainly is one of the main factors.

TABLE IV

SHRINKAGE OF TUBES

(Extruded bars with drilled holes of different diameter and cut in pieces of two different lengths)

OD (nozzle)	ID (drilled)	Length (1.082 in.)		Length (0.200 in.)	
		OD	ID	OD	ID
0.857	0.157	18.9	15.4	18.7	15.4
0.857	0.312	18.7	15.9	18.5	15.9
0.857	0.674	17.2	15.4	17.4	15.8

[3] H. H. Hausner and H. W. Lewenz, "Effect of Compacting Pressure on Dielectric Properties of High-Frequency Ceramics," *Ceram. Age*, **44** [3] 93–95 (1944).

TABLE V

SHRINKAGE OF EXTRUDED TUBES OF SAME OUTSIDE BUT DIFFERENT INSIDE DIAMETERS, CUT IN PIECES OF TWO DIFFERENT LENGTHS

OD (nozzle)	ID (pin)	Length (1.082 in.)		Length (0.200 in.)	
		OD	ID	OD	ID
0.857	0.171	18.2	24.8	18.2	24.8
0.857	0.316	17.9	18	17.9	18
0.857	0.685	16.1	14.7	16.1	14.7

IV. Summary

From the foregoing, it may be assumed that laws of shrinkage of extruded tubes can be found. It further is probable that the pressure distribution during the extrusion process plays a great role in this shrinkage. It may be taken for granted that some changes in the pressure distribution essentially influence the shrinkage of the tubes. The study of the pressure distribution is a complex research in itself, but it seems worth while to make further investigations in this direction to acquire more clarity in the complicated matter of the shrinkage of extruded tubes.

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THE DESIGNER AND THE AMERICAN MARKET*

FOREWORD

A symposium on "The Role of the Designer with the Manufacturer and the Buyer," originally scheduled for one of the meetings of the Design Division at the Forty-Seventh Annual Meeting, could have been most interesting, for there could have been a timely discussion between the ceramic manufacturer, designer, and buyer. To add to the interest, an editor from *Retailing—Home Furnishings* was scheduled to give her viewpoint as an interested observer.

Unfortunately, the buyer's and the manufacturer's viewpoints will not be printed here, for it has been impossible to obtain these papers. Mrs. Grimes, however, has ably given her opinion as an editor. The designer's viewpoint is given on p. 252.

A TARIFF WALL ISN'T ALL

BY VIRGINIA LIVINGSTON GRIMES†

No one familiar with import competition for United States china and glassware in normal times will underestimate its importance. A tariff wall, however, is not the only answer to the coming problems of market competition, any more than imports themselves will be the only competition which china and glass manufacturers must face after victory. The basic fight, as always, will be for the consumer dollar, come good times or bad, and the industry that is progressive, promotional, and aggressive will get those dollars.

From the viewpoint of an editor concerned with new product development, merchandising, and consumer acceptance, the china and glass industry has a long way to go compared with its potential competition. There is a curious ivory-tower complex in the field which, although it has its 18th century charm, is a weakness. With the exception of a handful of companies, public relations are almost nonexistent, while they do not exist at all for the industry as a whole, neither now nor in normal times. Designers must be acutely aware of just one phase of this, i.e., the general failure to present new designs to the public in such a way as to stimulate interest, the too-frequent lethargic sink-or-swim attitude toward merchandising a line which may have taken months of design and technical labors in the factory.

Trade relations, at their glowing best early in the war, have slipped, no matter how much the retailers appreciate the multiple production problems brought by war. A major industry promotion needs to be done on the ability of the industry to service the dealer quickly and better than anyone else. This is closely linked with public relations; the store is of course the primary contact with the consumer. Secondary contacts, which hardly seem to enter the consciousness of some in the field, are the consumer press, editorial as well as advertising; the trade press; radio programs, especially those directed at women; motion pictures; women's clubs; and active museums.

The need for action is urgent; it can quickly be too late. The industry is thoroughly alerted by now to the concerted drives by many sources to slash or eliminate tariffs, with terms such as "inefficient high-cost industries" appearing even in such publications as the *New York Times* in discussing tariff policy. In addition, the floodgates of competition may open at any time within the industry itself (glass versus pottery, china versus earthenware), and without the industry (the entire home-furnishings industries, housing, cars, and travel). Thirdly, imports will come back; the question is how much, how soon, and how good.

Timing of such promotional action is important, but one thing seems obvious: it is not necessary to wait until production is free again to start selling to the public (and a lot of retailers!) the caliber of the industry, its achievements in peace and war, the quality of its designs and products. It may even be dangerous to wait.

As a pattern for promotion of the industry, the following five-point program might be of some value:

(1) Clarification and patrol of terminology, especially at consumer levels, to protect quality as well as to educate the public on such terms as "china," "earthenware," "semivitrified," "lead" glass.

(2) Declaration of standards on first quality at least.

(3) Improved servicing of the dealer.

(4) Education of the retail salesperson through (*a*) sales training literature, (*b*) direct contact, (*c*) factory films and pictures, (*d*) display material and suggestions, and (*e*) follow-through on any national advertising.

(5) Reaching the consumer through (*a*) industry-wide promotion of American ware and achievements, (*b*) greater coordination with other home furnishings, (*c*) cooperation of the press, radio, etc., (*d*) effective presentation of new merchandise, (*e*) establishing brand names that mean something, (*f*) recognizing and building up the designer, and (*g*) encouraging creative efforts and then making sure the public learns of them.

Because the designer is responsible for the vital selling elements of attractive and useful merchandise, his interest in promotion of the product is or should be self-evident. There is more strength than ever in union, and a group such as the Design Division of The American Ceramic Society should be of invaluable assistance to such promotion. You are familiar with the technical advances with which you work. You must know what market wants are to anticipate what the consumer will like. You know WHY you developed such a shape, such a pattern, such colors. You have the selling points at your finger tips, selling points that far too often are never told to the consumer. In Sweden, the designers sit on the board of directors for such reasons. Why not here?

* Received March 21, 1945.

† Retail News Editor, *Retailing—Home Furnishings* (formerly china, glass, and lamp editor).

ROLE OF DESIGNER

By Vincent Broomhall*

The designer, who supposedly designs what appears on the market, is not entirely responsible for what actually reaches the market. He is governed to a great extent by the manufacturer, who in many cases restricts him as to what to do and what not to do. This is due to the fact that many manufacturers hold too great a fear for what they term "straying away from established designs" both in shape and tradition.

If more freedom were given to the designer, he would in turn very likely place better designs on the market. His desire to create would inspire him to do better things.

Preplanning a line or item by the designer and the sales department is most essential. In preplanning, enough ideas are derived from both departments to arrive eventually at something interesting and worth while. A line should be planned by those who know and not just by those who are in a position to say what is going to be done.

In the dinnerware field, is it possible to discontinue the old tradition of maintaining the various sizes and items established years ago by the early potteries? Could not many of these sizes be revised and better sizes be made? Also, could not some of these items be eliminated? For example, is it necessary to make four-, five-, six-, seven-, and eight-inch plates? It is entirely possible that three sizes of plates could satisfy this purpose.

Great effort has been put forth in technical development and much success has come from it. Designing and merchandising of pottery have not advanced accordingly. The dealer alone should not be entirely responsible for the promotion of pottery. The manufacturer could cooperate more in this promotion and merchandising and thus go far in establishing American ceramics on the market. In this respect, the glass industry has done well along these lines.

The British potters are planning much for their postwar market in America. This will give them a strong foothold on the American market. It would be most timely if American ceramic manufacturers would give more serious thought to promoting American design and American ceramics.

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* President, Continental Kilns, Incorporated, East Liverpool, Ohio.

FELLOWSHIP ESTABLISHED BY VITRIFIED CHINA ASSOCIATION, INC.

Robert F. Martin, Executive Secretary of the Vitrified China Association, Inc., Washington, D. C., has announced the establishment of a Research Fellowship at the National Bureau of Standards under the sponsorship of this Association. The Fellow will spend part of his time in individual plants. The work at the Bureau will be directed toward the establishment of accelerated use tests for vitrified china and the determination of new product standards and will ultimately result in the development of better ware.

The Association is interested in a properly qualified ceramist for this work, which will start at once. The salary will be approximately $4000 a year. The Fellow should be a ceramic graduate and have some experience in the whiteware field. Anyone interested in this work should address Mr. Martin at the Association office, 1010 Shoreham Building, Washington 5, D. C.

COATING FOR WIRE-WOUND RESISTORS

At a meeting of the resistor and ceramic tube manufacturers held March 25 at the Navy Department Bureau of Ships in Washington, D. C., the Office of Production Research and Development of the War Production Board announced a new water-repellent and thermal-shock resistant coating for wire-wound resistors. The research developing this new type of resistor coating was carried on by E. E. Marbaker under the O. Hommel Company Fellowship at the Mellon Institute of Industrial Research, Pittsburgh, Pa., and was sponsored by the Office of Production Research and Development of the War Production Board.

Dr. Marbaker was assisted by a Committee of recognized ceramists, metallurgists, and resistor manufacturers.

The coating is a member of the new group of resins known as Silicones. Because of its high elasticity, it can be applied to any combination of ceramic or metal tubes with high-resistance wire of suitable electrical characteristics.

The resistors have been tested according to rigid Navy specifications and have met the most exacting requirements. They have the highest resistance to moisture penetration when operating at maximum temperatures of 275°C.

WESTINGHOUSE SPONSORS BETTER METHODS ELECTRIC PROGRAM

Youths from forty-six states are this year launching a unique program to find better methods of doing farm and home work with electricity.

The Better Farm and Home Methods Electric Program is an expansion of the annual 4-H Club Rural Electrification Contest which has been held for many years. This program, carried on under the direction of the National Committee for Boys and Girls Club Work, is sponsored by the Westinghouse Electric Corp., Pittsburgh, Pa., through the Westinghouse Educational Foundation.

The program will reach its climax in December, 1945, when state winners will be given all-expense trips to the National 4-H Club Congress in Chicago to compete for six $200 college scholarships. The trips and scholarships are provided by the Westinghouse Educational Foundation.

The main objectives of the program as approved by the Washington Office of the Extension Service, United States Department of Agriculture, are (1) to develop a questioning attitude toward methods and equipment used on farms and in the homes and to determine and develop practical improvements for more profitable and enjoyable farm life, (2) to acquire a working knowledge and skill in the most effective and profitable utilization of electricity on the farm and in the home, (3) to develop plans for utilizing electricity and electrical equipment most efficiently in the improvement of the farm, home, and community, and (4) to pass this knowledge on to others for improving farm and home methods and raising the standards of living in the community.

Nearly 15,000 of the Nation's farm young people entered this program last year. Their activities ranged from completely electrifying farms to inventing devices that electrocuted mice as they ran across a granary floor.

Membership in
The American Ceramic Society
FOR CONTINUING EDUCATION
IN CERAMICS

COMMITTEE REPORTS

REPORT OF COMMITTEE ON RESEARCH

ARTHUR A. WELLS, *Chairman*

Research activities at a number of the colleges and institutes have been curtailed during the past several years due to a lack of graduate students, instructors, and engineers. Many research projects have been conducted directly for the War and Navy departments, or of like importance for the Office of Production Research and Development of the WPB, War Metallurgy Committee of the National Academy of Sciences, and the National Defense Research Council. Some of this work is of a confidential nature which cannot be disclosed by the investigators.

In spite of the personnel limitations, the extent of wartime research is bolstered by the interest and strong determination on the part of all so engaged. The war projects under way and the ever-growing recognition of the vital part research will play in the future have increasingly stimulated research.

Enamel

Fundamental research on enamel adherence, effect of composition on properties, and development of new types of enamels has been reported. Numerous enameling manufacturers have converted their plants for production of war materials entirely different from their peacetime production.

Work on ceramic coatings for steel, designed to protect the metal against corrosion under operating conditions of temperature and thermal shock, has been under way for the past several years (22).* The application of these coatings to war uses has been studied.

Further work has been carried out on the use of Mo in enamels. Reported for the first time were new low-temperature enamels containing MoO_3 smelted into the batch. Further attention has been given to white Mo enamels.

Progress on one-coat white enamels has been reported. Successful operations of a one-fire white actually involves three problems: steel, enamel, and the technique of application. A new vitreous enameling alloy steel has been developed which permits white or light pastel cover-coat vitreous enamel to be applied directly to the steel surface.

The influence of MnO alone and in combination with Co and Ni oxides on metal precipitation in ground coats has been studied (1). The presence of MnO alone in ground coats did not bring about a detectable precipitation of metal even when available in double the minimum effective percentages of Co and Ni oxides; MnO in combination with Co and Ni oxides showed no significant indirect influence on metal precipitation.

A study was made of the properties of five typical enameling clays and the action of these clays when milled with various types of enamel frits. The pickup characteristics of enamel slips were compared for the individual clays as well as for several clay combinations at different specific gravities and times of aging. There was no decided effect of the variation in the mineralogical composition of these clays on the properties of the enamel slip, although the clays showing the lowest pickup probably contained the most quartz. There was no direct correlation between clay particle size and various other properties. The pickup was closely related to the initial salt content as shown by hydrogen-ion curves. The weight loss of the clays did not appear to be related to the bubble structure in the fired enamels, although some correlation might be expected. The amount of bubbles in the fired enamels was found roughly proportional to the total carbon content of the raw clay as determined by combustion methods.

The pickup of enamel slip varied with types of frit and clay used. The pickup obtained with a mixture of two clays was usually less than the average of the values of the two clays alone. The pickup weight increased more and more rapidly as the specific gravity of the slip was raised.

A symposium was held on enamel tests concerning the metal and preparation of metal surfaces for porcelain enameling, tests for fineness and consistency of enamel slips, abrasion, impact, and bond tests, acid attack, and methods used in studying the properties of enamel frits.

The Enameled Utensil Manufacturers' Council has sponsored a standard thermal-shock test for porcelain enameled utensils (15). The test method used proved to be satisfactory and correlated with field experience. The results showed that an increase in the thickness of enamel over the commercial range resulted in a decrease in the thermal-shock resistance and that increases in the thickness of the stock had only a slight effect on increasing the thermal-shock resistance. A study of the character of the failures and the behavior of the ware under test indicated that thermal-shock failures are the result of the expansion and contraction of the bottom of the utensil which puts strains in the enamel coating.

The abrasion resistances of enamels, differing in composition and properties, were determined by the standard P.E.I. abrasion test. Although a rather wide difference in abrasion resistance was found between the best and poorest enamels, the results, for the most part, seemed to fall within a relatively narrow range. The results showed no one type or class of enamels as being superior in abrasion resistance. Although variation in formula affected abrasion resistance, apparently comparable results can be obtained with many compositions. The highest abrasion indices were obtained with those enamels lowest in specular gloss. If loss of specular gloss is accepted as the proper measure of abrasion resistance, the test used would seem to answer the requirements for uniformity and reproducibility.

The resistance of various surfaces to gouging was determined on the National Bureau of Standards gouging machine (15). Different enameled and glazed surfaces, polished glass, and typical plastic materials were examined.

Further work has been conducted on the determination of opacity of white enamel frits using powdered enamel frits suspended in kerosene and measuring the decrease in light transmission with a Cenco-Sheard-Sanford photelometer (1). Similar measurements were made on the same frits after fusing and on fused mixtures of clay and frit to determine the influence of temperature and clay additions on light transmission.

A study has been made to determine whether plastic flow occurs in glass coating on steel. The prime purpose was to determine whether or not any change in the compressive stresses would take place over a period of time and whether the compressive stresses were high enough to justify an expectation of plastic flow at room temperature. Steel rings were glass coated, and some were split at one point immediately and others one or two years later. Identical movement of the rings caused by compressive forces in the glass indicated that no plastic flow took place in the glass. The compressive forces were calculated and found to be of the general order of 10,000 lb. per sq. in.

A new enamel has been developed, which reportedly is much superior to previous enamels for wire-wound resistors for electronic equipment.

Work sponsored by the Office of Production Research and Development, WPB, has continued on enamel-covered wire-wound resistors (23) designed to pass the specifica-

* Numbers in parentheses refer to references given at the end of this report (see p. 259).

tions of the services (JAN–R–26). This investigation has included the development of other than ceramic films on the ceramic tubes, as Silastomer coatings which successfully meet the specification. The behavior of the resistor has been found to depend a lot on the material and quality of the ceramic tube. The expansivity of the tube was without significance because of the high elasticity of the coating, providing the tube can withstand thermal shock. Thus, equally good results have been obtained with cordierite, glass, high alumina, zircon porcelain, and electrical porcelain, all of which are lower in expansivity than steatite, and all of which have better resistance to thermal shock.

Other research projects reported include strontia as an ingredient in the enamel batch (24); study of nickel flashing and its relation to enamel adherence; evaluation of one-coat enamels for kitchenware; properties of clays in enamels (15); properties of enamel slips; titanium steel for vitreous enameling; crazing of electric stove tops in service; and the application of the process of electrostatic spraying to the porcelain enamel industry.

Glass

The properties and behavior of glass in the annealing region have been studied from many viewpoints in recent years. A recent study concerned chiefly the manner in which the low refractive index of a chilled or poorly annealed glass increased to equilibrium and the derivation of basic equations for a quantitative approach to index annealing. Theoretical analysis of the data showed that the molecular reaction which caused the index to vary was not of the familiar, simultaneous, first- and second-order type.

The importance of the structural homogeneity in various uses of glass is well known, and the whole problem of annealing is considered primarily as a means of attaining this homogeneity. A recent study has considered whether it is possible to obtain a glass homogeneous enough for a given purpose without its having been completely stabilized and how to obtain the best possible annealing in a given time. A considerable gain in annealing time can be obtained, not by seeking the highest refractive index or the best stabilized glass, but by emphasizing the importance of structural homogeneity. A specific method of cooling permits freezing into a homogeneous state a piece of glass that is not in equilibrium at the final temperature. Nevertheless, the glass was found to be suitable even for precision use.

The effect of temperature on the homogenizing rate of soda-lime-silica glass has received further attention. Density-spread determinations were made on a series of melts prepared at temperatures ranging from 1232° to 1454°C. A sharp drop in density spread in the range of 1232° to 1288°C., a minimum at 1325°C., and a slowly increasing density spread at temperatures above 1325°C. were observed. The portion of glass responsible for the major part of the density spread was found to be concentrated in the top half of the glass at both 1232° and 1454°C. The data afforded by these experiments lend further emphasis to the view that convection currents in commercial tank operations are highly significant in improving the homogeneity of a soda-lime-silica glass.

The effect of MgO is important in the glass industry because of the widespread use of dolomitic lime both with and without calcite lime. A study was made of the results obtained when CaO is replaced by MgO in two typical soda-lime-silica glasses in steps of 2% for CaO. The substitution of MgO for CaO in both the 10% and 12% CaO glasses caused at first a lowering of the liquidus temperature and then an increase and resulted in an increase of viscosity at high temperatures throughout the respective composition range. The substitution of MgO for CaO caused a continuous improvement in the resistance to dilute acid in both the 10% and 12% lime glasses and caused a decrease in resistance to distilled water.

The effect of fluorine and phosphorus pentoxide on properties of soda-dolomite lime-silica glasses has been reported. Fluorine was found to be very effective in reducing the viscosity and increased the liquidus temperature of the base glasses investigated. Fluorine did not decrease the chemical resistance in the range of compositions studied. The fluorine compounds are probably vaporized above the annealing temperature of a glass. Phosphorus pentoxide has but little effect on the viscosity characteristics when it replaces SiO_2. The viscosity is increased when it is substituted for dolomite lime. Phosphorus pentoxide did not affect the resistance properties in the range investigated when it replaced either $CaO \cdot MgO$ or SiO_2. The tendency of glasses to become opalescent when phosphorus pentoxide was present suggested that it is not desirable in soda-lime bottle glasses.

An investigation of the fluxing ability of SrO relative to BaO and PbO in low-temperature borosilicate glasses has revealed that SrO is a superior flux in glasses high in fluorspar and low in Al_2O_3 (15). This effect has been traced to the high solubility of fluorides in SrO-bearing glasses. A substitution of SrO for PbO in low-temperature borosilicate glasses was found to decrease the fusibility, if the fluorspar is low and the Al_2O_3 is high, or increase the fusibility, if the Al_2O_3 is low and the fluorspar is moderately high.

It has been found that titania can be introduced into sodium silicate glasses up to 50 weight per cent to form transparent glasses. High-titania and high-lead glasses were found to be strikingly similar in their optical properties such as refractive index and dispersion.

A study was made of some properties of Na_2O-SiO_2 glasses within the temperature range 900° to 1400°C. The best density, surface-tension, and viscosity data were studied and correlated with composition.

Factors have been derived for the calculation of the surface tensions of glasses from their compositions. It has been reported that this property can be computed as an additive function of the composition to within about 4 dynes per cm. at 1200° and 1400°C.

Further work has been carried out on the measurement of the softening point of glass by the fiber elongation method to improve the apparatus and the procedure. The accuracy of the softening-point determinations was found to depend on the ability of the furnace to duplicate its over-all rate of heat transmission. The homogeneity of the glass being investigated had an important bearing on the agreement of the test results.

A high-temperature viscosimeter for rapid control testing of production-line glass has been developed. The apparatus is a modification of Lillie's concentric cylinder viscosimeter, designed to give control-test accuracy and reliability at a rate of speed commensurate with the requirements of this type of measurement.

Procedures for testing the common constituents in glass by means of the spot-test technique using organic reagents have been presented in a form suitable for routine control (7). A technique for the nondestructive sampling of glass samples was developed.

The melting rate of a typical soda-lime glass was studied in relation to the grain sizes of raw materials and additions of cullet. The complete solution of silica grains was used as a criterion of melting. It was found that when grain sizes of all raw materials are the same, glasses become batch free at a rapidly increasing rate as the mean grain sizes are reduced. If the grain sizes of the materials are different, the time required to become batch free is increased, probably due to batch separation during melting. When the grain sizes of the raw materials differed, the addition of cullet tended to minimize separation during melting and thus reduced the time required for the glass to become batch free. The first increments of cullet added appeared to have the most marked effect in reducing the time required to obtain batch-free glass.

Factors influencing the accuracy of tests for segregation in glass batches have been discussed. Poor mixing of glass batches or segregation during handling can be the cause of cords and other glass defects. It was shown that by using small samples, removing or accounting for the cullet, and standardizing the method on a miniature

batch, valuable information could be obtained as to the homogeneity of the batch mixture.

A research was sponsored by the Glass Container Association of America on a refined method of control of cordiness and workability of glass during production, using statistical control charts applied to daily measurements of density. The charts were found to be practical in the analysis of causes of variation, in maintaining a control during current production, and keeping lack of control within tolerable limits. It was claimed that dominant variability and the causes of many unusual variations in density lie in the batch house, often in the scales. An average 3-day range of density of not more than 0.0012 is a reasonable goal for any plant; 0.0006 is excellent and 0.0009 is good performance. Chemical analyses are usually less precise than density measurements and can best be used only for trouble-shooting purposes.

The available methods for determining the properties and practical aspects of cords that occur in pressed and blown glassware have been described. Informative properties that aid in the detection and evaluation of cords include viscosity differences, lumpiness, ridges, or grooves in the finished ware, visible refractive index differences, density differences measured in the laboratory and calculated from composition data, unusual strain seen in the polariscope, and composition differences between separated fractions of the glass.

A method has been developed for measuring the time required to produce seed-free glass. The fining time is claimed to be an independent property and not a function of viscosity.

The action of surface tension in molten glasses has been discussed in relation to cord persistence. Interfacial tension is considered only one of the several factors which influence the spreading and sinking of surface cords. Lengthening and flattening in immersed cords is caused by the thermal and mechanical mixing of the viscous liquids and not by surface-tension relationships. Diffusion rates were stated to be a measure of the net rate of solution of cord glass, whether the cord is immersed or floating.

Methods have been described for the separation of cords and stones from the surrounding glass and for the semimicrodeterminination of SiO_2 and Al_2O_3. The latter analyses are found to be rapid and accurate.

A very extensive report has been made on the various types of glass stones actually found under operating conditions in furnaces melting soda-lime bottle glass. The possible source of each type of stone was considered along with general methods for its identification and elimination.

Measurement of the weight losses which occur when various mixtures of calcium fluoride and silica are heated at 1400°C. indicated that SiF_4 is volatilized from melts which are made in a dry atmosphere (15). If the atmosphere is moist, the volatilized material is H_2F_2. A practical application was made to increase the chemical durability of a glass surface. In this method, a fluorine-bearing glass was heated in a moist atmosphere at about 900°C. for about one hour. The slow evolution of SiF_4 and its reaction with moisture produced a silica-rich glass surface of greater resistance to attack than that possessed by the untreated glass.

The physical and chemical properties of glasses in the low-expansion group, which are prepared by a unique method involving leaching and refiring, have been discussed. These glasses have been referred to as "reconstructed" or "96% silica" glasses. The relatively soft borosilicate glass is melted and shaped, the fluxes are removed by leaching, and the residual porous high-silica structure is consolidated by heating. The outstanding properties of this type of glass are reported to be low coefficient of expansion, high thermal endurance, high softening point, low power factor, and high chemical durability. The glass can be used continuously at temperatures up to 900°C. or for limited service at much higher temperatures provided it is not in contact with materials which react with or cause devitrification of silica. The glass has varied applications in the industrial and electrical fields. A translucent or opaque white glass, made by the same process, enables the production of massive ware and a variety of shapes that cannot be made directly in the clear form.

A research was conducted to obtain evidence of the nature of fire polish on sheet glass. Newly drawn sheet glass probably has a crystalline layer several molecules thick. This layer has a higher index of refraction than the glass, but it is counteracted by the rapid absorption or chemical action of water as soon as the glass is dampened.

The deterioration of glass in tropical regions with high relative humidity results in transparency decreases due to growth of deposits of corrosion products, chemical decomposition of the surface layer, or contamination of the surface by organic material. The chemical reactions involved in tropical deterioration are similar to those involved in chemical reactions between water and glass in nontropical climates. The best preventive has been found to be protection from moisture during shipping and storage plus frequent cleaning of exposed glass surfaces during use.

The principles of decolorizing pot glass have been reviewed (3). The conditions noted that produce well-decolorized glass included purity of raw materials, presence of oxidizers, and proper amounts of complementary colorants.

Other glass researches now under way or recently completed include fundamental properties and surface chemistry of glass (7); constitution of extra-dense flint glass; phase-equilibrium studies of the system $NaF–BaF_2$ (7); technical glassware (23); production of crystal-clear glasses in continuous tanks; flow lines in continuous melting furnaces; new laws for flow processes in glass; governing factors in glass; effect of inhibitors on fluorescence in glass (14); supersonics applied to glass research; and microstrength of glass.

Materials and Equipment

The use of the nonmetallics has expanded tremendously in the past few years and they have rendered services of inestimable value in the war program. A few of these minerals which have found use or increased use during the war include diatomite in the production of heat insulation products, talc in steatite bodies, lovite (a lime bentonite), Eyrite (a magnesium silicate), vermiculite in the production of insulating brick, perlite, rutile, clinochlore, lepidolite, amblygonite, spodumene, garnet as a substitute for corundum, anorthosite, periclase, olivine, and others.

Study is being made of the temperatures at which certain heat effects, such as thermal decomposition, take place in nonmetallic minerals and the effect of impurities on these temperatures (7). The heat effects are being determined by the differential thermocouple techniques.

An investigation was made of the fundamental properties of raw clay influencing their use (15). The cation-adsorption capacity and the nature of the adsorbed cation were found to be closely related to the heat of wetting, pH, and equilibrium moisture. For a given adsorbed cation, these properties related directly to the intensity of adsorption of the ion. The properties of clays may be defined as functions of ion-sorption capacity, nature of the adsorbed cation, and packing, providing the water content and soluble salts are controlled.

A fundamental study was made on the bonding characteristics of types of clay based on their clay-mineral composition. The rigidity of the water held on the surfaces of the clay minerals seemed to be a dominant factor determining the bonding and plastic properties of clays. Each type of clay mineral appeared to have a characteristic ability to stabilize water, and the exchangeable ions also exerted an influence.

The flow properties of six monodisperse kaolinite fractions were studied over a large range of concentration (2). It has been shown that the viscosity of a suspension of kaolinite in water is due to the contribution of the liquid, the separate particles, and the interference between the particles. This relation covers the entire range of concentration up to the point of dilatency.

Extensive deposits of kaolinitic clay and closely associated bauxite occur in Pulaski and Saline counties, Arkansas. These clays normally contain more than 35% of alumina. Siderite is the principal impurity. On account of the size, quality, and accessibility of these deposits, further investigation and testing as to their availability for use as refractory clays was suggested.

An investigation has been conducted of the chemical composition of the water-soluble fraction in Iowa clays (12). This consisted of the repeated extraction of water-soluble compounds and the chemical analysis of the residues after evaporation of the extracting solution.

A systematic study of Alabama shales is under way (5). Shales from 104 deposits have been sampled and tested. A number of very excellent shales as well as some with unusual properties have been found in areas where no ceramic products are being manufactured at the present time. Work has been started on the development of new uses.

The problem of the more efficient use of slate and of slate waste is being attacked simultaneously from five points of view: test methods, mineral composition, study of physical and chemical properties, separation of slate waste into component minerals, and development of new products from slate (7). Progress has been made on each of these phases. Cooperative industrial tests are planned as a means of investigating the technologic problems involved in the commercial production of several possible new products from waste slate.

Laboratory and pilot-plant tests have demonstrated that the South Carolina sillimanite schists are amenable to beneficiation by recognized mineral-dressing methods (20, 21). Standard-size brick made from the concentrates met A.S.T.M. and Navy specifications for superduty refractories.

A survey is under way of the high-grade sand resources of New Jersey with special reference to those suitable for use as glass sand and as a source of high-grade quartz for other ceramic products (9). Various processes of mineral beneficiation are being used.

The physical and chemical treatment of gypsum, for its improvement and for obtaining new products, has been given thorough-going research (23); calcination has been studied exhaustively.

The Office of Production Research and Development, WPB, has sponsored work on mica. Test equipment has been developed to determine the suitability for use in capacitors. Considerable mica, previously discarded, has been found satisfactory for certain types of capacitors.

Work has continued on glass-metal and ceramic-metal seals for capacitors, transformers, and other electronic components requiring hermetic sealing.

An OPRD project has resulted in the development of a new type of spectrograph for sight reading instead of the photographic method. Percentages of the elements present are read directly off a chart.

Application of microchemical spot tests to ceramic and mineral problems has continued (7). Problems involving the rapid identification of small amounts of special elements, present in ceramic raw materials and products, have been solved by the use of organic microchemical tests.

Infrared driers are finding increasing ceramic applications for drying glaze on brick, glaze on steatite, drying frit, and drying hotel ware. It is claimed that in addition to marked reduction of drying time, better working conditions, more uniform results, and lower operating cost are attained. Infrared can be applied to drying greenware, glazes, and overglaze decorations.

Other researches include X-ray diffraction control methods; X-ray, thermal, and chemical examination of Texas clays (17); development of zircon as ceramic material; production of kyanite grog from Virginia kyanite (11); abrasives (23); developments in grinding ceramic materials; new developments in glaze spraying equipment, and a thermal study of kiln furniture.

Refractories

A symposium was held on the significance of tests on refractories. The value of tests from a practical and research standpoint and the significance of a testing program on steel-plant refractories and glass-plant refractories were discussed. Test data on fire-clay and silica refractories were presented, which showed the effect of firing temperature and its relation to the changes brought about in the standard A.S.T.M. reheat tests. With the development of the Navy spalling test, thermal spalling in naval boilers has been reduced from a major to a minor cause of failure.

In previously reported work it was found that South Carolina topaz furnished an excellent bond for calcined domestic kyanite. Research has been continued to explore the use of raw topaz with calcined and raw domestic kyanite as refractory materials. Refractories prepared using either calcined or raw kyanite with raw topaz were well bonded. Kyanite retains some of the topaz decomposition products and will absorb such volatiles if heated in close contact with raw topaz. These volatiles may account in part for the bonding action of raw topaz. Addition of raw topaz decreased the volume expansion of raw kyanite. Very good refractories were produced when a mixture of equal parts of raw and calcined kyanite was combined with raw topaz.

Tests were conducted to determine the value of calcining and defluorinating raw topaz for use in refractories (20). The rotary kiln seemed to offer a practical means. Defluorination to less than 0.5% can be effected by a calcination procedure that can be maintained without difficulty.

An investigation (20) was undertaken to produce a standard-size firebrick which would weigh between 4.5 and 6 lb. and would meet the A.S.T.M. Specification C27–40T and the more severe Navy reheat specifications, 32B 2C; both specifications require a P.C.E. above cone 33. Combinations of calcined domestic kyanite with raw topaz were used. Carbonaceous materials were incorporated in the mixtures to produce a porous lightweight body; best results were obtained with anthracite. A refractory was produced which will meet the severe Navy specifications and having a P.C.E. of cone 37 or above.

With the many recent developments in the technology and manufacture of chrome-magnesite refractories, considerable attention has been attracted to the fundamental nature of these materials and their reactions with other materials. An investigation has been made of solid-state reactions of simple magnesia spinels with alkaline earth orthosilicates (15). Petrographic microscopy and X-ray diffraction were employed in the identification of the reaction products.

A study was based on experiments in which two series of chromium oxide-alumina fusions containing 10% and 30% Cr_2O_3, respectively, were fused in an electric-arc furnace with MgO up to 5% and with FeO up to 5%. The determination of the effect of SiO_2 and TiO_2 on the primary crystallization of these fusions was the chief purpose of this work. Within the limits studied, SiO_2 up to 3% and to a lesser extent TiO_2 up to 3% tended to inhibit or decrease the solid solution of Al_2O_3 in spinel. As the amount of Cr_2O_3 increased in a chrome ore-alumina fusion, the Al_2O_3 became less soluble in a $MgO(AlCr)_2O_3$ phase. As the amount of iron was increased up to 5% FeO in a chrome ore-alumina fusion, the Al_2O_3 became less soluble in the $(FeOMg)O$, $(CrAl)_2O_3$ phase.

The extremely wide range in the types of refractories used in glass-tank regenerators has interest in view of the more or less fixed theories of the properties which are most important in a checker-brick. A much denser fire-clay brick of high silica content may possess merit. Progress is being made with a siliceous fire-clay refractory of considerably greater density than heretofore produced. By virtue of greater density it is considered logical to expect the rate of wear to be slower.

Data have been presented on the slag resistance of the copper reverberatory refractories (2). Porosity was found to play an important role in the behavior of silica brick.

Fire-clay brick behaved satisfactorily at 1300°C., but were not recommended for high-temperature operation. High-alumina brick were attacked more readily than the ordinary and superduty firebrick due to their porous and basic nature. Magnesite and chrome brick seemed to be most suitable. A close-packed mixture of coarse chrome grains and finely ground magnesite particles was also suggested.

The use of low-fired grog compared with high-fired grog in dry-pressed refractory bodies containing 50% grog and 50% clay was found to produce greater dry and fired strength, higher firing shrinkage, lower absorption, and higher resistance to slag penetration (3). Grog fired between 500° and 700°C. gave the best results. In general, bodies containing 50% low-fired grog had better properties than those containing 90% of the low-fired grog.

A study was made of the factors affecting the pyrometric cone equivalent of silica fire clay made of ganister, clay, and silica-brick culls. The P.C.E. was found to be highly responsive to changes in grind, the coarser grinds giving a higher P.C.E. The P.C.E. was lowered by increases in clay content from 15 to 40% clay. The nature of the P.C.E. end point and its dependence on heating rate and on the viscosity of the liquid developed largely eliminated the usefulness of phase-equilibrium data for P.C.E. studies, which are not dependent on these factors. Phase-equilibrium data require homogeneity and the attainment of equilibrium, while the data obtained show the dependence of P.C.E. on grind.

The well-known use of boric oxide as a mineralizer has been applied to magnesia and magnesia-containing bodies in ceramic processes (7). Equilibrium in the system $MgO–B_2O_3$ has been investigated for compositions from 0.6 to 75 weight per cent MgO. Three intermediate compounds were found. $MgO·B_2O_3$ melts incongruently at 988°C. to form $2MgO·B_2O_3$ and a liquid containing more than 99% B_2O_3. The other two compounds melt congruently: $2MgO·B_2O_3$ at 1340°C. and $3MgO·B_2O_3$ at 1366°C. At 1142°C., a region of liquid immiscibility extends from 0.6 to 36.0% MgO.

A preliminary survey of the information published in the fields of chemistry and physics on the suboxide forms of SiO, TiO, ZrO, CrO, AlO, BO, VO, and CbO indicated a new field to be explored in determining the role of these suboxides in the service and failure of refractories and in the chemistry of slags. Suboxide forms may be used to clarify discrepant data and to explain certain behaviorisms of slags and refractories which at present seem anomalous. These suboxides are difficult to study because they are high-temperature forms unstable at ordinary temperatures. New phases might be found, such as suboxide fayalites, sillimanites, and chromites; and secondary effects on established phases may be found, such as devitrification nucleated by the chemical action or deterioration effected by the escape of the often volatile suboxide.

The volume expansion of cristobalite, as it passes through the low-temperature inversion range, was studied by means of a dilatometer in which the cristobalite expanded against a column of mercury, and the volume change was measured in a capillary tube attached to the mercury column (7). The cristobalite inversion phenomenon was found to take place over a range of temperature and to exhibit a variable volume effect, depending on the origin, history, and composition of the samples. The inversion temperature varied in heating and cooling, the temperature on cooling being the lower. The volume change on inversion is a function of the cristobalite present in the sample, possibly influenced by the temperature of formation, presence of added catalysts, and grain size. The method of analysis used should be of value in estimating the cristobalite content of silica brick.

A study of the oxidation of iron in iron-bearing silicates is of interest in the manufacture of basic refractories (7). When a silicate mineral containing divalent iron as a lattice constituent is heated in air the iron is oxidized and rejected from the lattice.

Work has been under way on the development of a refractory body having exceptionally high resistance to thermal shock (1). Various compositions containing refractory clays with the addition of talc, corundum, mullite, zircon, and other minerals are being studied.

Other research projects on refractories include special refractories for the services (12); X-ray diffraction data for compounds in the $CaO–MgO–SiO_2$ system; use of gypsum in the manufacture of lightweight refractories (23); use of Virginia kyanite in insulating refractories (11); effect of atmosphere on insulating refractories (24); testing chrome-magnesite brick for resistance to iron oxide bursting (7); furnace for multiple testing of reduced-size samples under load (7); factors influencing the size variations in stiff-mud fire-clay refractories (24); mottled or colored silica brick (23); effect of furnace gas pressure on the life of refractories (23); development of bodies for tips in high-temperature furnace design (24); stress-strain relations in ceramic materials (24); packing of particles (15); and study of emissivity of some refractory materials (15).

Structural Ceramics

The Glazed Brick and Tile Institute is sponsoring studies on the fire resistance of glazed-brick construction and of the weathering of glazed structural clay products (24).

The National Clay Pipe Research Corporation is sponsoring a project on better practices in sewer-pipe manufacture and use (24).

The Structural Clay Products Institute has sponsored a project to determine the manner in which moisture penetrates hollow-tile-masonry walls (12). The water permeability of small hollow-tile-masonry wall specimens was measured. Two kinds of construction, one type of mortar, and eleven kinds of tile were tested in a group of twenty-three walls by means of the procedure reported in the National Bureau of Standards Building Materials and Structures Report BMS 82, "Water Permeability of Walls Built of Masonry Units." Although a major portion of the work previously outlined has been completed, the results indicated that more work will be required before satisfactory conclusions can be drawn.

The Office of Production Research and Development, WPB, is sponsoring the development of ceramic space heaters for the Government's housing program (24). The project was primarily a metal conservation study. The specification was to produce a small heater, round or square, about 35 inches high and less than 30 inches overall in diameter. The models were to range from 25,000 to 40,000 B.t.u. per hour with an efficiency of from 35 to 45%. In competition with the metal stove, numerous problems had to be faced. Numerous tests were run to determine the best ceramic body.

The National Research Council is sponsoring a project on the development of coatings for welding rods (24).

A study was made of the cause and methods of preventing the splitting of Hudson River soft-mud brick (3). Tests made on various portions of the brick showed that the black portions were more vitreous and had lower thermal expansions than the outer, more oxidized portions. On cooling, the stresses resulting from the difference in thermal expansion were such as to tend to split the brick. Modification of brick mixes and method of setting have been recommended to overcome black coring.

Other research projects include study of bond characteristics of structural clay products and mortar in masonry (11); aging of dry cold-set mortars (23); development of a cellulated clay aggregate for use in the cement industry (24); new efflorescence test (3); study on increasing life of brick and tile dies; drying of ceramic products, moisture movement, and moisture rates (15); and study on Illinois clays and shales as mortar mix (15).

Whiteware

Work sponsored by the Office of Production Research and Development, WPB, has continued on steatite insulators (6). A portion of this project covered control of shrinkage of extruded bodies. A body has been developed, which has a dry compressive strength up to 9000

pounds per square inch. This body can be machined more rapidly than the present commercial body. Work has been completed on a compounded body, as a substitute for block talc for electronic tube spacers, which has excellent low-loss characteristics. Several steatite bodies have been developed which will meet the American War Standard low-loss L–6 classification.

An attempt was made to correlate the differential shrinkage of fired steatite talc with the particle shape of the raw talc used in their manufacture. The results of this investigation indicated that particle shape does control differential shrinkage and that differential shrinkage is affected but not controlled by particle size. Another investigation carried out at a steatite plant indicated that although particle-size distribution in steatite talcs has a bearing on the firing shrinkage, the differences in grinding, normally found in commercial talcs, are not of a great importance. There were indications that coarser grinding may be advantageous for ceramic users from a cost standpoint and may be used without entailing radical changes in shrinkage. There appeared to be no change in the ratio of diametral to longitudinal shrinkage in extruded bodies attributable to the particle size of the talc.

Control of raw materials for steatite manufacture has been discussed. Blending of various talc shipments has furnished a uniform talc supply by minimizing variations within a car and from car to car. The procedure as used by one steatite manufacturer consists of putting the material in a hopper and transferring by screw conveyer to four mixers. Various shipments are thoroughly mixed. The talc is then conveyed again by screw conveyers to six storage bins. Material for production is drawn from several bins at one time, providing additional mixing.

An investigation of the electrical properties of glass in the $MgO–Al_2O_3–SiO_2$ system was made (9). The results of this study showed that the electrical properties of the glasses did not vary to any great extent with changes in composition. They also indicated that the crystalline phases of dielectric material, such as steatite, have a greater effect on the electrical properties than the glassy phases.

The successful development of zircon porcelains has opened a new field of high-frequency ceramic insulation which promises to become increasingly important. These new porcelains are also finding other uses where their unusually favorable combination of thermal, mechanical, and high-temperature electrical characteristics recommends them to replace materials commonly used. New and more severe applications are continuing to develop, so that a permanent position in the field of electrical porcelain seems assured.

The services now have joint specifications for electrical porcelain, steatite, and glass insulators. These covering specifications are given as follows:

Radio Insulators, Glass	JAN–I–9
Glass-Bonded Mica	JAN–I–7
Steatite	JAN–I–8
Porcelain	JAN–I–21
Insulating Materials, Ceramic	
Dielectric, Class H	JAN–I–12
Ceramic, Class L	JAN–I–10

The insulating material used must conform to the requirements of Joint Army-Navy specification JAN–I–10. Army specification 71–4935 covers pin-type, lime-glass insulators for use in supporting conductors on open wire communication and signal lines.

Ceramic capacitors are covered by specification JAN–C–20. Extensive work has continued on the ceramic dielectric fixed capacitors.

A study was made to determine by simulative service tests the suitability of a series of ceramic bodies for cooking ware, in which talc, flint, and calcined kaolin were the variables (3). Bodies which gave best results contained approximately 10% of New York talc and also a small amount of calcined clay substituted for potters' flint.

The effect of additions of New York State diopside on properties of wall-tile bodies was studied (3). It was found to lower the fusion temperature and to lower thermal expansion when compared with talc and to raise thermal expansion when compared with feldspar. The effects on firing shrinkage, fired absorption, and moisture expansion were somewhat similar to those of talc. Diopside has the disadvantage of producing a buff color when used in large quantities at higher temperatures.

Moisture-expansion studies were made over a period of more than three years on bisque and glazed specimens of two types of semivitreous bodies having approximately the same absorption. A cone 6 talc-pyrophyllite body showed less moisture expansion under all conditions of exposure than a cone 9 clay-flint-feldspar body. A three-year storage period appeared to be sufficient to give expansion values which closely approached the ultimate that may be expected. The autoclave treatment gave maximum expansion values, and such exposure should indicate the resistance of ware so tested to delayed crazing due to moisture expansion.

A survey has been made of the literature on plasticity, viscosity, and allied properties (8). Most industries have standardized on the measurement of viscosity. Characteristic apparatus used in each industry for measuring rheological properties was described.

An extensive investigation on steatite bodies has involved the development of binder combinations having specific forming properties and a system of shrinkage control which can be used with these binder combinations (6).

A study was undertaken in an effort to determine whether certain tests could be used to classify and compare the binding power of the various types of organic materials used for obtaining dry strength (9). It was found that samples of the dry body subjected to a tumbling test gave informative results regarding the strength and behavior obtained from the use of certain binders.

A study made of deflocculants, as used in clay slips, revealed the variable effect of such deflocculants on the physical properties of plaster molds.

Other studies on whiteware bodies include heat-shock-resistant bodies (1), low-temperature porcelain body for art potters (24); use of soda feldspar for the flux in whiteware bodies (24); rapid firing and low cone bodies; effect of mold shape and pressure on firing shrinkage of steatite bodies; and effect of grain-size control on properties of casting slips (2).

The United States Potters Association has sponsored research on leadless glazes (24). The order limiting the use of lead issued late in 1944 made this work of timely importance. A leadless glaze should be selected, free of other critical materials, and the permissible amount of lead added. The use of some strontium carbonate to replace lime appeared desirable. In general, the replacement materials which were found of interest included the carbonates of strontium, barium, and lithium and the fluorine minerals topaz, fluorspar, cryolite, and sodium silicofluoride. Lithium minerals are valuable when the iron impurities are sufficiently low.

The U.S.P.A. has also sponsored a research on the development of a standard test for the solubility of lead frits (24). With the increasing use of lead bisilicate in glazes, the best alumina content to use in the bisilicate is of concern from the standpoint of acid resistance, frit fusibility, and amount of alumina which can be added as clay. The methods of analysis and the percentages of dissolved lead obtained from different lead bisilicates have received attention (24).

A study was made of the effect of composition changes on the appearance of raw, leadless, boron-free glazes (15). No more than 0.05 equivalent of MgO nor more than 0.2 equivalent of ZnO should be introduced in raw leadless glazes; BaO substituted for CaO gave greater fluidity; BeO increased the refractoriness of this type of glaze; no benefits were derived from the use of LiO_2; nepheline syenite promoted early vitrification and was preferable to feldspar; fine grinding was recommended; SrO increased

the fusibility of the glazes and provided for larger ranges of Al_2O_3 and SiO_2.

The production of two-fired vitreous ware using a nepheline syenite body biscuited at cone 4 with a glaze of low expansion maturing at cone 01 or below has received continued study (24). Glazes maturing at cones 02 to 01 and fitting a vitreous nepheline syenite body biscuited at cones 4 to 5 have been described. To insure the best glaze fit, the total alkali content should not exceed 0.05 molecule and the MgO content should not be below 0.15 molecule. To produce adequate fusibility, the PbO content should be between 0.30 and 0.35 molecule. One or more of the following oxides should be used with CaO to fill the remainder of the RO group, ZnO, SrO, and BaO. The property of the nepheline syenite bodies to take up silica makes possible an increased SiO_2 content, resulting in better hardness and greater resistance to crazing.

Methods and principles have been discussed by means of which suitable glazes for low-expansion bodies and durable low-temperature glazes may be prepared (15). Low-expansion cordierite bodies have not been glazed by the usual conventional glazes. Similar problems are encountered in special low-temperature glazes for standard bodies. Because glazes are weak in tension, very small tensile stresses result in crazing. On the other hand, the compressive strength of glazes being very high, glazes can sustain quite high compressive stresses without ill effects. In fact, it is common practice to produce ware in which a high compressive stress in the glaze is intentionally maintained.

Strontia has proved to be a strong flux and a desirable glaze ingredient when it is used to replace PbO, ZnO, and CaO in a typical dinnerware glaze (24). A base-glaze molecular replacement of PbO with SrO raised the deformation temperature, fused viscosity, thermal expansion, and water solubility but lowered acid solubility. Replacement of ZnO with SrO slightly raised the deformation temperature, thermal expansion, and acid solubility and lowered the fused viscosity and water solubility. Replacement of CaO with SrO raised the deformation temperature slightly in the raw glaze but lowered it in the fritted batches, lowered fused viscosity and water solubility, and increased the acid solubility. Molecular replacement of CaO in a soda-lime glass with SrO increased thermal expansion and lowered fused viscosity and deformation temperature.

Studies have been made on the influence of various fluxing compounds on the gloss and opacity of zircon glazes for one-fire ware at cone 11.

A method for determining glaze penetration was developed, and the effect of glaze penetration on glaze fit was studied (3). Glaze penetration was found to depend on the constituents in the glaze and on the body to which the glaze is applied. The oxides of boron, lead, zirconium, and cadmium, when incorporated in the base glaze, proved most generally effective in promoting penetration in all bodies. These findings are of interest in view of the influence that glaze penetration has on glaze fit.

The effect of firing atmosphere on the development of colors in ceramic glazes from 100% oxidizing to 100% neutral has been studied (9). The light-green calcium-chrome glazes changed from blue green for 100% nitrogen to yellow green for 100% oxygen. Vanadium-tin yellow glazes changed from yellow toward orange. Chrome-tin pink and maroon glazes showed a variation in lightness.

A report was made on glost kiln refractories. Saggers for glost placing must give good life and avoid harmful secondary effects on the ware. Low thermal expansion is a most necessary property but, if carried too far, may cause pin chipping. Using saggers carrying talc and pins containing no talc, it was found that the pins chipped the ware. By adjusting the respective thermal expansions and using a pin body containing talc, the difficulty was eliminated.

A study of factors involved in glaze-slip control has been continued (15). Experiments were conducted to find a simple, adequate means of specifying glaze consistency. Tests showed that the amount of slip clinging to a glass plate after it was withdrawn from a reservoir of slip (coherence value) was directly influenced by such factors as amount of water, clay content, and age. These factors are commonly thought of as governing the working quality of slip. Surface tension has little apparent relation to the working qualities of the slip. Examination of the fired glazes revealed that a distinct coherence value separated good glazes from poor types.

An attempt was made to correlate the thickness of deposition of glazes with the air permeabilities of the bodies (15). The correlation was satisfactory under certain restricted conditions but not for general cases. An adequate correlation was obtained, independent of the type of body, between thickness of glaze deposition, glaze consistency (coherence value), and water receptivity. The correlation between glaze consistency, body receptivity, and thickness of deposition is represented by a simple first-order equation. Coherence-value and receptivity measurements were suggested for use as a check on incoming raw materials, a basis for selection of certain raw materials, a control test for slip consistency, and a basis for blending clays and other raw materials.

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(21) Southern Experiment Station, U. S. Bureau of Mines, Tuscaloosa, Ala.
(22) National Bureau of Standards, Washington, D. C.
(23) Mellon Institute of Industrial Research, Pittsburgh, Pa.
(24) Engineering Experiment Station, Ohio State University, Columbus, Ohio.

Further Committee reports will be published in the August issue of The Bulletin.

REPORT OF SPECIAL COMMITTEE ON GLOSSARY AND STANDARDS

This title has been carefully chosen to indicate clearly one of the most outstanding needs of this Society, of ceramic art, of industry in general, and of persons concerned in any way with the definitions and evaluation of ceramic raw materials and finished products.

A glossary is defined by Webster's Dictionary as "a partial dictionary of a work, an author, a dialect, art, or science, explaining archaic, technical, or other uncommon words."

A standard is defined as "that which is set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality."

Science is "knowledge classified and made available in work, life, or the search for truth."

According to its Constitution, the purpose of The American Ceramic Society is "to promote the ceramic arts and sciences."

From these definitions alone, it is obvious that the chief work of this Society is to promote ceramic sciences and that this involves the classification of knowledge. It is equally obvious that classification in turn depends upon agreement with respect to (*a*) the meanings of words and terms, (*b*) the bases for classification, and (*c*) methods of procedure in establishing standards.

For fifty years, The American Ceramic Society has promoted the ceramic arts and sciences by the reading, discussion, and publication of papers and the preparation of bibliographies. A great amount of information has thus been secured and recorded.

The time has come, however, when more emphasis should be placed upon the condensation and classification of this knowledge, the establishment of standards, and the publication of such authoritative information in such form as to be of the greatest service to those who will follow in this field during the next generation.

GLOSSARY

The beginning must be made by agreement as to the meaning of words or terms peculiar to ceramic arts and sciences.

Ceramists comparing data may be seriously misled if they are not talking about precisely the same thing.

The distortion and misuse of ceramic terms is, in my opinion, increasing rather than decreasing.

There are many words and terms used exclusively in the field of ceramics to designate raw materials, finished products, items of production equipment, and details of manufacturing procedure.

In this report, I need only give a few examples to illustrate my criticisms of the present situation and provide a basis for suggestions toward improvement.

Considerable work has been done with respect to raw material definitions. One group under Dr. Ries compiled a list of clay definitions about five years ago. There were certain justified criticisms of some of the names used but the start was a good one and the work should have been carried on to as near completion as possible.

As a result of discussing this at a meeting of the Board of Trustees on June 7, 1939, the following item appeared in the minutes of that meeting:

"(12) *Ceramic Terms and Definitions.* The impossibility of securing immediate agreement on terms and definitions was described. President Andrews told of his experience in trying to get concurrence in agreement on terms and definitions relating to enamels under the auspices of the Porcelain Enamel Institute. Dr. Ries described the effort and the unsatisfactory results obtained in trying to secure agreement on clay definitions. Dr. Ries' clay definitions will be published in the June *Bulletin*. It was moved by A. S. Watts and R. E. Birch that the clay definitions, as published in the June *Bulletin*, be considered for one year as tentative and, if further amendments cannot be agreed upon, that they should then become the standard definitions."

This speaks for the clay and vitreous enamel groups.

In an article in the January, 1943, *Bulletin*, p. 6, Professor Watts comments as follows, presumably speaking mostly for the pottery field: "Ceramic terminology is hopelessly confused. We find terms constantly misused and the public is often misled with no remedy because no standard definition exists."

In my opinion, Professor Watts is right. So also are Professors Ries and Andrews in complaining of difficulties, but these difficulties can and must be overcome.

A few examples of incorrect ceramic terminology are given herewith:

Porcelain has been in a class by itself for the greater part of the thousand years since its discovery by the Chinese. Many of the best books upon ceramic art have been called "Pottery and Porcelain," recognizing the unique position of this superlative product of the potter's art. Within the past few years, however, the term has been used quite incorrectly not only by those unfamiliar with the field of ceramics but also by ceramists themselves.

In a letter dated January 9, 1945, which I received from one of the outstanding producers of sanitary pottery, the following statements are made:

"The glazed surface of vitreous china fixtures is acidproof against all acids except hydrofluoric.

"Porcelain ware on the other hand, and as more commonly explained in the plumbing fraternity, while made with a clay body and glazed in a similar manner, and quite as acidproof as vitreous china, has for the most part a heavier wall structure and uses a less refined clay.

"The body is not completely vitrified and it is not resistant to the absorption of moisture through the surface that is not glazed. This rate of moisture absorption is so great that in a few years after installation the glaze of a porcelain fixture crazes. This is purely a case of wear; because of moisture absorption the body expands and the glaze, being perfectly fitted to the body, does not follow; hence, minute hairlines will appear on the glazed surface. This is obvious evidence that the body has expanded and is not a completely vitrified piece of material."

I understand that the makers of plumbing fixtures have given up this incorrect use of "porcelain" in referring to glazed earthenware, but apparently the stigma still remains.

That "porcelain" is quite incorrectly used in referring to "vitreous enamel" I have pointed out many times to leaders in the vitreous enameling industry, but nothing can be done there because "a million dollars has been spent in selling the public on the idea of porcelain enamel."

Even the official bulletin of the ceramic course in one of our leading colleges refers to vitreous enameling as porcelain enameling, and, incidentally, to china as "dinnerware."

Webster's Dictionary defines stoneware as "a species of coarse potter's ware, glazed and baked."

In a recently published and expensive work in two volumes on Pottery and Porcelain by Warren E. Cox, the introduction is followed by a table of definitions of which the very first is "alumina is china clay or kaolin." This at once weakened my confidence in the correctness of any other explanations of ceramic terms which the publication might offer, and in running further through the list I learned that pottery was synonymous with terra cotta and under terra cotta you are simply asked to see pottery.

Concerning pottery, Mr. Cox says, "More definitely it is used to name all classes of baked clay wares which are not stoneware or porcelain." Then follows a rather long-drawn-out and surprising definition of pottery. Lastly, Mr. Cox defines ball clay as "a plastic clay which stands high temperatures without wilting." What a flower!

Who of us can clearly distinguish between faience and majolica, although S. G. Burt presented a paper upon the subject before this Society many years ago?

How many ceramists know the differences between the various types of tile as classified by the trade, as ceramic mosaic, Roman mosaic, wall tile, faience tile, quarry tile, and flint tile? Where would one find information concerning these?

In addition to the incorrect use of long-used ceramic names, new words and names are coined from time to time with but little semblance to a carefully considered ceramic classification. I would refer particularly to "dinnerware." How would we intelligently and satisfactorily define "dinnerware"? How does it differ from semichina, if we know quite definitely what the latter means. And what is semiporcelain?

That our terminology is confusing, even to ourselves, there can be no doubt.

Besides the names of ceramic raw materials and finished products, there is need of also explaining for nonceramists words used in ceramic manufacturing operations and equipment, such as blunger, sagger, stilt, jigger, grog, frit, slit, etc.

In Federal Specifications WW–P–541a covering vitreous china plumbing fixtures, definitions are given for various terms referring to quality, such as craze, dunt, fire-check, pinhole, etc. I cannot find that The American Ceramic Society has ever defined these and similar terms used almost exclusively in the ceramic industry.

A glossary of ceramic terminology is of value not only to ceramic technicians but also for general reference in connection with contracts, tariffs, patent litigation, specification writing, the editing of technical or other publications, library references, and in other fields.

I would therefore recommend and urge this Society to at once take steps to prepare a well-considered glossary to cover the principal words and terms used in our industry.

First of all, those to be entrusted with this work should set down the best definitions available, as those of Professor Ries for clays and Professor Watts for whiteware. Then these should be reviewed upon some rational basis of classification and redefined when necessary.

For instance, ceramic materials might be defined upon the basis of (1) structure or composition, (2) properties, (3) uses, (4) otherwise.

For most materials, definition upon the basis of (1) and (2) would suffice and (3) and (4) used only to indicate special products.

It would certainly seem unnecessary to separately list basic definitions and others for secondary or trade names. In the Ries list of clays, for instance, after defining kaolin and china clay there is no need to define such terms as paper clay, rubber clay, pipe clay, etc. If we are to have separate terms for all possible uses of a material we will have an endless number.

But this is not the place to discuss methods of procedure.

After a satisfactory glossary has been prepared by a thoroughly qualified committee, it should be printed as a separate publication by this Society and distributed to both the membership and all important outside groups which should be interested, such as A.S.T.M., A.S.A., national bureaus such as Standards, Mines, and Patents, to chief editors of important publishing houses, the most important libraries, etc.

Above all, our membership should be asked to use this terminology and our own Editorial Committees should insist upon uniformity of terminology in our own publications.

Constructive criticisms, however, should be invited.

After the initial distribution, a charge should be made for additional copies.

STANDARDS

As indicated at the outset, a standard is defined as that which is set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality."

In my opinion, we should confine our efforts to establishing methods of test and not concern ourselves with specifications which are contracts involving adherence to prescribed standards.

Standard methods of test are required for both raw materials and finished products. Tests for finished products involve material tests and design tests,[1] with both of which we are often concerned.

Considerable work has been done in developing standard methods of test for ceramic materials both within and without The Society.

Much of this has been excellent.

The reported results are scattered through our own and other publications. There is no one reference covering the standard methods of test for ceramic materials.

In a rather hurried and incomplete survey of references to the testing of ceramic materials I found the following:

Manual of A.S.T.M. Standards on Refractory Materials (Committee C–8), June, 1943.	
Refractory materials	22
A.S.T.M. Standards.	
Other ceramic materials, including glass, porcelain, brick, tile, etc.	43
American Ceramic Society Standards. *Jour. Amer. Ceram. Soc.*, **11** [6] (1928).	
Tests of raw materials and finished products	39
P.E.I. (1944), National Bureau of Standards (1944), and Other Groups. (Federal Specification WW–P–542) Acid Tests, etc. (Federal Specification WW–P–541a)	
Vitreous enameled metal	25
U. S. Bureau of Mines.	
"Syllabus of Clay Testing," Bulletin No. 451, 1943	10
National Bureau of Standards, Circular CS–23–30 (1930).	
Methods of testing feldspar	2
National Bureau of Standards, Circular CS–111–43 (1943).	
Earthenware (vitreous-glazed) plumbing fixtures	5
American Ceramic Society *Journal* and *Bulletin*, 1944.	
35 articles dealing with 68 tests	68
Total	214

There are probably as many more.

It is highly desirable to collect, edit, and publish these tests or references to them and also to provide for a continuation of this work.

In a paper entitled "Testing Whiteware Clays," which appeared in *The Bulletin of The American Ceramic Society* (**21** [11] 287–91 (1942)), Hewitt Wilson and Herschel Hixon stated, "This paper is a plea for renewed activity in revising and devising improved tests for clays of the whiteware type."

Even in the field of refractories, for which, as shown above, A.S.T.M. has established and published a carefully developed set of tests, more work can apparently be done, for in a paper entitled "Testing Refractories from the Standpoint of Research," which appeared in *The Bulletin of The American Ceramic Society* (**23** [9] 315–17 (1944)), Fred A. Harvey states that more and improved tests are needed.

It has been suggested that we turn over the testing of ceramic materials to the A.S.T.M., but there are many ceramic tests which A.S.T.M. would not feel justified in handling, as, for instance, tests of raw materials and tests for those properties of finished ceramic products restricted to certain special fields.

Tests for the plasticity or workability of clays or clay mixtures, fusibility of feldspar, and the dry strength of clays are practically of value only to the ceramic industry. So also are such tests upon finished products as the effect of washing compounds upon the overglaze decoration of ceramic food service products, abrasive resistance of ceramic thread guides, temperature shock resistance of chemical ware, and the crazing of structural tile and sanitary ware, which tests are each of outstanding importance for determining the service values of the products involved.

In many cases, upon the other hand, tests developed by A.S.T.M. and other groups are no doubt adequate and deserving of adoption by this Society.

[1] L. E. Barringer, "Significance of Material Tests and of Design Tests Upon Electrical Insulating Materials," *Proc. Amer. Soc. Testing Materials*, **36** [Part II], 592–99 (1936).

It is my recommendation that we reorganize our Standards Committees along the following lines:

First, a Standards Editorial Board to review, edit, approve, assemble, and publish the standards developed or approved by the Divisional Standards Committees.

Second, Divisional Standards Committees whose business is to develop standard methods of test for the raw materials and finished products within the scope of the Divisional activities or to approve standards developed by outside groups.

The Standards Editorial Board need not be constituted on the basis of Divisional representation.

The Divisional Standards Committees should be made up of producers and consumers when possible. A definite procedure should be worked out for procedure and recording methods of test, preferably following A.S.T.M.

Membership of the Divisional groups should be made up of those in a position to give constructive assistance, as, for instance, those to whom laboratory facilities are available, such as those in the employ of the National Bureaus of Standards, Mines, etc., large corporations with private research and control laboratories, universities, and research foundations.

As the work progresses, I would like to see consideration given to over-all questions, such as references to pyrometric cones.

In most of the references I have seen in our literature to pyrometric cone measurements, the source of the cone has not been mentioned. Even in A.S.T.M. tests for refractories, the source of cone is not mentioned, although specific temperatures are indicated for definite cone fusions.

In a recent side-by-side test in our tunnel kiln of two makes of cones there was a difference of a full cone.

In any technical research and development work, therefore, reference to the kiln temperature merely by cone number is quite inadequate. As long as cones furnished by various producers vary in performance under identical conditions, it will be as necessary for accuracy to refer to the cone by name as it is to stipulate temperature as Fahrenheit or Centigrade.

A further complication exists in that both of the producers of the two cones tested claim precisely the same temperature equivalents. They cannot both be right, and therefore a reference to cone without further identification, followed by reference to the corresponding temperature, may be doubly misleading.

Furthermore, there should be a reference to the rate of heating when temperatures are given to correspond to cone performance.

There should be some plan developed for more definite pyrometric cone references in ceramic literature, such as Orton Cone No. 1 (1125°C.–SF), in which SF stands for slow firing.

When outside tests are approved and made available in the literature of other organizations, they might simply be referred to so that those interested can obtain access to such tests. It seems unnecessary to reprint such outside tests, as has been done with A.S.T.M. tests for ceramic products, and in fact it is bad practice, as our own records of such tests are not kept up to date, whereas A.S.T.M. tests are revised frequently.

Indication of approved and tentative tests on the part of The American Ceramic Society might be given by appropriate designating marks.

As a final suggestion, it may be advisable to publish our Society Standards in loose-leaf form to be kept up to date by new sheets from time to time. These could readily be sold at $2 each, with the understanding that this would include revisions for three or five years when each holder would receive a bill for a charge to cover the service for another period to be agreed upon.

—L. E. BARRINGER, *Chairman,*
Special Committee on Status and Activities of The Fellows

Other members of this Committee are: Francis C. Flint, W. Keith McAfee, Louis Navias, Robert B. Sosman, and J. W. Whittemore. Committee appointed by President Fritz by authorization of the Board (see *Bull. Amer. Ceram. Soc.*, **24** [1] 24 (1945))

REPORT OF COMMITTEE ON PUBLIC RELATIONS

The Committee on Public Relations has not been too active during 1944–1945. The Public Relations Committee, however, does have a large and active field in which to function. It can do work of a very important nature for The American Ceramic Society.

It occurs to the Chairman of this Committee to suggest that the Committee outline its program and then have the General Secretary of The Society carry through the plans of the Committee.

It is recommended that this Committee prepare an outline embracing frequent press releases emanating from the general office of The Society. These press releases would outline the importance of various ceramic products and would in a few years establish the worth and scope of ceramics in the public mind. This is in itself important and a far-reaching matter.

The creation of ideas can originate in the Public Relations Committee. The execution of these ideas, however, should be a function of the office staff of The Society.

It is further recommended that the Public Relations Committee prepare a program to extend over the next twelve months for the purpose of bringing the importance of ceramics to the attention of the public. Perhaps the best method of accomplishing this is through properly prepared press releases.

Another field is the promulgation of suitable legislation for the protection of scientific societies such as The American Ceramic Society and to combat inimical legislation such as was proposed by Senator Kilgore.

Once this Committee starts functioning it can undoubtedly do a lot of constructive and helpful work for the promotion of the usefulness of the activities of The Society.

—V. V. KELSEY, *Chairman*

REPORT OF SPECIAL COMMITTEE ON PUBLICATIONS*

This Special Committee was ordered to (1) review the relations of The Society with the trade press, (2) review the Rules of The Society regarding publications, (3) review the Rules for the Presentation of Papers, and (4) make recommendations to the Board on the foregoing items at the Annual Meeting.

The Committee has reviewed (1) the principal correspondence between Society officers and *Glass Industry* concerning the availability of Society papers to the trade press, (2) The Society's Rules on publication matters, and (3) the instructions to authors of papers.

Each member of the Committee has independently presented his views on the matter at hand, from which the following recommendations are made.

Recommendations

(1) That no changes in the Rules of The Society in regard to publications and relations with the trade press be made at this time.

(2) That principles of policy in regard to handling of papers, dealing with the trade press, be made by the Editor and The Society's Committee on Publications subject to approval of the Board.

(3) That this Committee be discharged.

—J. L. CARRUTHERS, *Chairman;* J. T. LITTLETON, W. KEITH MCAFEE, R. L. STONE, AND J. D. SULLIVAN

* Special Committee appointed by President Fritz following action of the Board (see *Bull. Amer. Ceram. Soc.*, **24** [1] 24 (1945)).

The report of the Standing Committee on Publications will appear in a later issue of *The Bulletin*.

DIVISION COMMITTEE REPORTS

REPORT OF WHITE WARES DIVISION LIAISON COMMITTEE

Sixteen or eighteen years ago, a committee of whiteware research and executive personnel was organized to represent the whiteware industry in discussions on current problems in the industry. They met informally at the National Bureau of Standards in Washington, usually in the fall of the year, and spent a day discussing ceramic research projects of all kinds. Such discussions would usually bring out an evaluation of the projects with reference to the importance as they were discussed. New ideas and opinions on the projects were openly discussed to give the Bureau members the benefit of the industrial conception of the problem.

This off-the-record interchange of knowledge is perhaps the highest type of ceramic research promotion possible. Any group composed of ceramic executives, research technologists from the industry, and fundamental research scientists of the National Bureau of Standards is apt to arrive at widespread conclusions in a manner that will promote action. The whiteware industry differs from other large industries in that most of the executives are very close to the ceramic research problems, and it is fortunate for the industry that men of this type can get together and discuss such problems in round-table conferences.

The problems discussed at these meetings were somewhat as follows:

Bodies: A study of artificial fluxes and the determination of their relative effects in bodies for the purpose of developing vitrified and water-absorbent whiteware maturing at temperatures below 1000°C. (Completed; see "Study of Some Ceramic Bodies of Low Absorption Maturing at Temperatures Below 1000°C." by R. F. Geller and D. N. Evans, *Bur. Stand. Jour. Research*, **9** [4] 473–85 (1932), R.P. 483, and "Auxiliary Fluxes in Ceramic Bodies" by Paul F. Collins, *Jour. Amer. Ceram. Soc.*, **15** [1] 17–27 (1932).)

Raw materials: A comprehensive study of English china clays to be extended to include American clays and a more thorough study of the various fractions of these clays. (Completed; see "Some Properties of English China Clays" by T. A. Klinefelter, W. W. Meyer, and E. J. Vachuska, *Jour. Amer. Ceram. Soc.*, **16** [6] 269–76 (1933) and "Properties of Some American Kaolins and a Comparison with English China Clays" by T. A. Klinefelter and W. W. Meyer, *ibid.*, **18** [6] 163–69 (1935).)

Bodies: The preparation of semivitreous bodies made entirely from American clays. ("Substitution of Domestic for Imported Clays in Whiteware Bodies" by W. W. Meyer and T. A. Klinefelter, *Jour. Research Nat. Bur. Standards*, **19** [1] 65–79 (1937); R.P. 1011.)

Glazes: The determination of the amount of lead oxide and boric oxide lost from whiteware glazes by vaporization. (Active as part of study of system $PbO–B_2O_3–SiO_2$).

Glazes ($PbO–SiO_2–K_2O$): A fundamental investigation of the course of the reactions taking place during the fusion of those oxides used in the manufacture of glazes. ("System $PbO–SiO_2$" by R. F. Geller, A. S. Creamer, and E. N. Bunting, *Jour. Research Nat. Bur. Standards*, **13** [2] 27–44 (1934), R.P. 705; "System $K_2O–PbO–SiO_2$" by R. F. Geller and E. N. Bunting, *ibid.*, **17** [2] 277–89 (1936), R.P. 911; "System $PbO–B_2O_3$" by R. F. Geller and E. N. Bunting, *ibid.*, **18** [5] 585–93 (1937), R.P. 995. Study of the system $PbO–B_2O_3–SiO_2$ is active.)

Raw materials: A study of salts occurring in raw clays and the effects of these salts on the working properties of clays during the preparation of bodies to be used in the manufacture of whiteware. This would necessitate an investigation of colloidal phenomena including selective absorption, etc. (See "Colloidal Nature and Related Properties of Clays" by W. W. Meyer, *Jour. Research Nat. Bur. Standards*, **13** [2] 245–58 (1934); R.P. 706. No further work done.)

The effect of talc in whiteware bodies. (See "Thermal Decomposition of Talc" by R. H. Ewell, E. N. Bunting, and R. F. Geller," *Jour. Research Nat. Bur. Standards*, **15** [5] 551–56 (1936), R.P. 848; "Talc in Whiteware Bodies of the Wall-Tile Type" by R. F. Geller and A. S. Creamer, *Jour. Amer. Ceram. Soc.*, **18** [9] 259–69 (1935); "Talc in Whiteware" by R. F. Geller and A. S. Creamer, *ibid.*, **20** [5] 137–47 (1937). Further work is contemplated in connection with the study of tunnel-kiln schedules.)

In reading over some of the minutes of those early meetings, some interesting investigations have come to light, for example, the following quoted from the 1936 meeting:

"Talc in whiteware bodies: This work has progressed to the point where it is questionable whether further work should be done. The results are in such shape as to be published and if further work is desired, it would be best to reopen the project."

No one realized at that time they were dealing with the basis of the war-born steatite industry. Just how much benefit was derived from this early work is unknown, but it undoubtedly gave some ceramists a working knowledge of talc in whiteware bodies before the war program stepped it up to the high-priority place it now commands.

In the White Wares Division, the activities of this Committee are covered by the Research Committee, listed as follows under the Rules of the White Wares Division: (*a*) To act as an advisory board to the White Wares Section of the National Bureau of Standards and (*b*) to act as an advisory group in the matter of ceramic research on whiteware problems to such ceramic schools as desire to cooperate with the Committee.

It is surprising the amount of whiteware research going on in institutes other than industrial plant laboratories in a normal year. A large portion of this work is directed by people having their principal connection with industry through the facilities and committees of The American Ceramic Society, and vice versa.

The American Ceramic Society offers the most aggressive and competent bond between industry and the various public-supported research institutions. We should recognize this as a function of The Society and have groups of executive and research personnel available for any educational group or institution through which The Society can promote the best interests of ceramic advancement.

—J. R. BEAM, *Past-Chairman,*
White Wares Division

Another report of the White Wares Division, the Standards Committee report, appears on p. 214 of the June, 1945, *Bulletin*.

REPORT OF ENAMEL DIVISION BIBLIOGRAPHY COMMITTEE

The efforts of the Bibliography Committee have at last been realized, and 1000 copies of the Bibliography were printed and delivered to the office of the Secretary of The Society. In the first six months since the Bibliography was available, 289 copies have been sold and 26 free copies distributed, leaving a balance as of March 8 of 685 copies. The Committee has had to consider the question of keeping the plates of the Bibliography, as the storage charge on these was $80 per year. As a meeting of the Committee at the Annual Meeting was impossible, the Secretary's office contacted various members of the Committee and of the Division to get their opinion as to the printing of more copies or of holding the plates. The preponderance of opinion favored the releasing of the type and indicated a belief that the number of copies printed would satisfy future needs. Your Chairman was of the opinion that it

would be a good investment of $500 to have 500 additional copies printed, but did not wish to have his opinion prevail over that of the majority of those consulted.

Below is a statement of the status of the Bibliography's funds as submitted by the Secretary's office.*

Plans should be made immediately to arrange for the publication of another Bibliography covering the next ten-year period. These Bibliographies, in the opinion of your Chairman, are important enough that we believe that their compilation should be a permanent function of the parent Society. The American Chemical Society publishes a decennial index regularly, and, as the annual indexes have to be compiled anyhow, in our opinion the permanent staff of The Society should be increased to make this regular compilation possible, not only for the Enamel Division, but for all other Divisions as well.

—J. E. ROSENBERG, *Chairman*

* As of May 31, 1945, there is a balance of $850.07 in the Enamel Bibliography Fund.

REPORT OF ENAMEL DIVISION STANDARDS COMMITTEE

The Enamel Division Standards Committee report for the year 1944–1945 comprises (1) a review of the action taken by the Enamel Division on the recommendations of the Standards Committee as set forth in the report for 1943–1944 and (2) a summary of the results of a questionnaire on "Enamel Tests and Standards" which was sent to the members of the enamel industry.

The recommendations in the Committee report[1] for a definite procedure for the consideration of tests were approved and adopted as follows:

(*a*) The Standards Committee to make recommendations to the Enamel Division.

(*b*) The Enamel Division to vote for approval or rejection of the proposed test.

(*c*) The standard tests approved by the Enamel Division to be recommended to the Committee on Standards of The American Ceramic Society for final approval by the Board of Trustees.

The Enamel Division also approved[2] the recommendation of the Standards Committee in that the two tests (1) the Reflectance Test for Opaque-White Porcelain Enamels and (2) the Test for Acid Resistance of Porcelain Enamels (Flatware) were adopted as standard tests. The Enamel Division also approved the recommendation of the Standards Committee that three tests, viz., (1) the Test for Resistance of Porcelain Enamels to Gouging, (2) the Impact Test for Enameled Utensils, and (3) the Solubility Test for Enameled Utensils, be adopted as tentative standard tests of the Enamel Division. All five tests were recommended to the Committee on Standards of The American Ceramic Society and given final approval by the Board of Trustees.

To obtain information on the use of various tests in the enamel industry, the following questionnaire was sent to the various members:

I. Do you believe that standard tests and procedure should be established by the Standards Committee of the Enamel Division?

II. Which of the following tests have you used within the past five years?

(1) Fineness Tests: (*a*) Standard Test of the Enamel Division, (*b*) Recommended Test of the P.E.I., (*c*) Other.
(2) Cone Deformation Test.
(3) Reflectance Test for Opaque-White Porcelain Enamels (P.E.I. Test).
(4) Test for Acid Resistance of Porcelain Enamels (Flatware) (P.E.I. Test).
(5) Test for Resistance of Porcelain Enamels to Gouging (P.E.I. Test).
(6) Impact Test for Enameled Utensils (E.U.M.C. Test).
(7) Solubility Test for Enameled Utensils (E.U.M.C. Test).
(8) Surface Abrasion (P.E.I. Test).
(9) Torsion Test (P.E.I. Test).
(10) Impact Test (P.E.I. Test).
(11) Sagging Test (P.E.I. Test).
(12) Button Cylinder Test for Studying the Fusion Properties of Frits.
(13) Thermal-Shock Test for Kitchen Utensils (E.U.M.C. Test).
(14) Weight Pickup Test.
(15) Flow or Consistency Tests: (*a*) Flow Tube, (*b*) Bingham Plastometer, (*c*) Irwin Consistometer, (*d*) Mobilometer.
(16) Other tests which you are using and which are not listed.

III. Which of the tests listed in No. II, which are not standards or tentative standards of the Enamel Division, do you feel should be considered for adoption?

IV. What other process or development tests do you feel would be advantageous in the enamel plant?

V. Information on *test not applicable, lack of equipment, personnel not available for running test, test too cumbersome and time consuming, remarks* was asked for the following:

(1) Fineness Tests: (*a*) Standard Enamel Division, (*b*) Recommended by P.E.I., (*c*) Other.
(2) Cone Deformation Test.
(3) Reflectance Test.
(4) Acid Resistance Test.
(5) Gouging Test.
(6) Impact Test.
(7) Solubility Test.
(8) Surface Abrasion Test.
(9) Torsion Test.
(10) Impact Test.
(11) Sagging Test.
(12) Button Cylinder Test.
(13) Thermal-Shock Test.
(14) Weight Pickup Test.
(15) Flow or Consistency Tests: (*a*) Flow Tube. (*b*) Bingham Plastometer, (*c*) Irwin Consistometer, (*d*) Mobilometer.
(16) Other tests.

Out of a total of 463 questionnaires which were sent to the members of the enamel industry, 34 replies were received. In some of the laboratories, several members filled out the questionnaire collectively so that replies were received from approximately 10% of the group.

In reply to the first question, "Do you believe that standard tests and procedure should be established by the Standards Committee of the Enamel Division?" everyone sending in replies answered "Yes" except two who misinterpreted the question.

In answer to the second question, "Which of the following tests have you used within the past five years?" the following replies were received:

(*a*) The tests which had been used by the greatest number included the Test for Acid Resistance of Porcelain Enamels, Reflectance Test for Opaque-White Porcelain Enamels, Fineness Test (Standard Test of the Enamel Division and the recommended test of the P.E.I. used by about an equal number), and the Weight Pickup Test.

(*b*) The tests which were reported to have been used by an intermediate number included the Impact Test for Enameled Utensils, Solubility Test for Enameled Utensils, Button Cylinder Test, Thermal-Shock Test for Enameled Utensils, the P.E.I. Impact Test, Surface Abrasion Test, and the Sagging Test.

[1] "Enamel Division Standards Committee Report," *Bull. Amer. Ceram. Soc.*, **23** [5] 167–68 (1944).

[2] "Enamel Division Business Meeting and Panel Discussion," *ibid.*, [8] pp. 270–73.

(*c*) Only two members reported to have used the Cone Deformation Test and the P.E.I. Torsion Test.

Replies to the third question, "Which of the tests listed in No. II do you feel should be considered for adoption?" indicated that the greatest number felt that the Weight Pickup Test, the Button Cylinder Test, and the Sagging Test should be considered for adoption as standard tests.

The replies to the fourth question, "What other process or development tests do you feel would be advantageous in the enamel plant?" indicated that the need for a wide variety of tests exists in the enamel industry. A few of the tests which were listed included a Wearability Test, Gloss Test, Surface Abrasion Test, Alkalinity Test, Adherence Test, Color Tests, a standard method of determining the amount of nickel deposited on enameling sheet iron, drawing compound tests to find the drawing qualities and cleanability of the compound, and a satisfactory test for determining cleaner efficiency.

As was expected, a wide range of replies was received to the fifth part of the questionnaire. Many of the tests were not being used in the enamel industry because of the lack of equipment or because the test was too cumbersome and time consuming to run.

It is recommended that the three tests which were adopted as tentative standards last year, Resistance of Porcelain Enamels to Gouging, the Impact Test for Enameled Utensils, and the Solubility Test for Enameled Utensils, be considered for adoption as standard tests at the next meeting of the Enamel Division.

It is further recommended that the Standards Committee for the ensuing year consider for adoption as standard tests those tests which, as shown by the results of the recent questionnaire, were in greatest demand.

—R. L. Cook, *Chairman*

REPORT OF ENAMEL DIVISION EDITORIAL COMMITTEE

During 1944–1945, ten papers were received by the Editorial Committee for review. Nine of these papers have been returned to the Editor of The American Ceramic Society with criticisms and recommendations, and one paper is still in the hands of the Committee (April 14, 1945). Two papers were prepared for preprinting prior to the Annual Meeting. As is the usual custom, these papers were not submitted to the Editorial Committee for comment, although one of the papers was edited by the chairman of the Committee.

The matter of short-circuiting the Editorial Committee with papers prepared for preprinting has been discussed before this Division by several previous chairmen. The difficulty involved is, of course, the time limitation. As the papers are received in The Society office with no more than enough time to make preprinting possible, there is usually not sufficient time to allow the Committee to consider them in the usual fashion. These papers are carefully edited in The Society offices but do not have the technical editing afforded by the Committee. Although it may be argued that in presentation technical points are discussed, in view of the fact that The Society does not incorporate oral discussions of papers in its publications but simply proceeds to publish the preprinted articles as submitted, this argument is not valid. There is a possibility that this situation could be rectified in one of two ways. If an individual copy of the paper were sent to all members of the Editorial Committee simultaneously, together with a deadline for editing, the passage through the Committee would be greatly facilitated. Naturally, the Editorial Office could circulate the paper after it has been preprinted, but obviously that would be very expensive since any corrections would require a resetting of the type. This question is probably more or less academic in view of the fact that most of the papers thus prepared have come out in very good style.

—G. H. Spencer-Strong, *Chairman*

REPORT OF REFRACTORIES DIVISION RESEARCH COMMITTEE

During 1944, research on refractories was curtailed considerably owing to the war activity and lack of adequate personnel. The industry in general concentrated on improving the present products to reduce "down time" of various furnaces to the minimum. Interest was shown in improving the quality of silica brick by a better selection of raw materials. Great improvements have been made in the quality of silica mortars used with silica brick. These products were improved to the point where their refractoriness is practically equal to that of silica brick. Clay has been eliminated as the bonding agent, and the workability is regarded as excellent.

Considerable interest has been shown in the improvement and development of basic brick for open-hearth furnaces. Carbon refractories have been installed in blast-furnace bottoms, and these tests are now under way. Aluminum melting has required the development of special brick, and this work is still in the development stage. Magnesium-melting furnaces likewise were given special attention from a refractories standpoint.

Other allied refractory products such as plastics, castables, air-set mortars, etc., received the attention of the refractory engineer during 1944. Considerable attention was also directed toward the improvement of checker-brick in both the stiff-mud and dry-press methods of manufacture.

Methods of tests for refractories were carefully studied and a Symposium on "Significance of Tests on Refractories" was conducted during the 1944 Annual Meeting of The American Ceramic Society. The majority of the papers presented during the Symposium were published in *The Bulletin*.*

In the postwar period, many important research projects on refractories will no doubt be published. Moreover, the ceramic schools will again take up various problems in refractories when the personnel becomes available. We can look for continued progress and development in the field of refractories.

—Earl C. Petrie, *Chairman*

* See *Bull. Amer. Ceram. Soc.*, **23** [9] 310–20; [10] 367–73; [12] 457–68 (1944).

COLOR ENGINEERING

The use of carefully prepared color schemes for the interior of factory buildings, machines, and floors to improve the efficiency of workers is now called color engineering. It is of particular importance to manufacturers in the porcelain enamel, tile, and brick divisions of the ceramic industry.

The fundamental principles that underlie the relation between color combinations and psychological effects are being studied to determine the proper use of color in industrial plants. By proper adjustment of the color surroundings of the worker to the type of work being performed, a definite improvement in efficiency can be attained.

Several companies which have been color-engineered have reported not only improvement in output, but better quality, lower accident rates, smaller labor turnover, and fewer cases of eye strain.

Every factory has the problem of renewal of painted surfaces, with the consequent disruption of operations and the risk in working above and around operating machines. Once the proper color scheme is determined for the operations to be performed, the finish of the work space can be properly treated in permanent ceramic materials. Color will then be renewed with the regular cleaning operations.

Manufacturers of the various glazed ceramic products which go into architectural use will be interested in color engineering.

THE PRESIDENT'S PAGE

THE AMERICAN CERAMIC SOCIETY—WHY?

By C. Forrest Tefft

The American Ceramic Society is a vital part of the equipment of any person who operates in the ceramic industry. Why? Because The Society has rendered a unique service to its members for nearly half a century.

The American Ceramic Society is one of the few organizations in this country that speaks for all branches of one of the basic industries and which has been able to do so in an unbroken manner for forty-eight years. It commands this respect and attention because it fills an important place in the professional life of every technical man who is associated with the industry.

What services are available to the member which are so important? They are the services which he cannot obtain without the cooperation of his fellow members, or which would be so expensive as to be prohibitive if he did not join a cooperative enterprise to secure them.

First of these benefits are the meetings. No man can hold a meeting by himself! He must have a group of like-minded individuals, and it is usually easier if this is arranged for him by an organization.

The Annual Meeting of The Society is the high light of the technical and scientific activity of the ceramic industry in peacetime. It is the yearly conclave of the best minds of the industry to exchange information and experiences. Its importance has been better appreciated this year when wartime restrictions have prevented its gathering and have forced us to look for other means of keeping alive our professional acquaintanceships.

Local Sections are the means of giving the member a meeting place where all those with an interest in the ceramic industry will gather from time to time to discuss their problems. These meetings are held at short intervals and are made to fit the needs of the members of the local groups by placing special emphasis on the branches of the industry which are of the most importance in the Local Section area.

In normal times, Divisional meetings are held where intensive study of a particular branch of the industry takes place. These meetings are usually held in the fall and are located near the geographical center of the particular branch. Papers of an operating character are more numerous than those of a research or experimental character which are found in the Division meetings of the annual congress.

Thus meetings assume the most important place in the contact with members who can attend, but there is an equally important service for those who cannot be present. This is the reading material which The Society prepares.

Foremost of these publications is *The Journal*. Here are revealed to the members for the first time many of the original contributions to the art and science of the silicate industries. Here are set forth the important discoveries which members wish to have recorded and brought to the attention of others who are interested in like developments.

In *Ceramic Abstracts* will be found a complete review of the literature of the industry covering most foreign countries, including Russia. There is only one other technical publication like it in the United States and few more in the world. Recently the librarian of one of the larger engineering libraries rated *Ceramic Abstracts* as second only to *Chemical Abstracts* in completeness and detail. He indicated that it held an important place in every technical reference library.

To bring news of the members and The Society to the attention of the membership and to publish information on operating problems, *The Bulletin* is issued every month. This publication serves to keep members informed of the less technical happenings in the industry as well as to give them the latest personal connections of the individuals. It also serves the suppliers of the industry as a means of telling, through the advertising pages, the story of their products to a selected and receptive audience.

For members who want to advance further in the collective promotion of the industry, committee appointments are the usual course. The Society maintains committees to formulate and promulgate standards, to originate nomenclature, to foster research, to study patents, to promote the development of new outlooks for ceramic design, and in many other ways to encourage the progress of the industry. Those who serve on these committees not only perform a valuable service for the industry but have the satisfaction of associating with others who are interested in such work. It is a stimulating experience.

Some members are called upon to represent The Society in its contact with other organizations to speak properly for the industry. Such associations as the American Society for Testing Materials, the American Standards Association, the Orton Foundation, the National Research Council, the Air Hygiene Foundation, and the Inter-Society Color Council have representatives from The American Ceramic Society.

Although the affairs of The Society are natural items for national publicity and are adequately reported by the various trade papers, as well as the general publications, The Society maintains a Public Relations Committee to further the interests of the industry. This Committee has been particularly successful in correcting misconceptions of the ceramic industry by Government agencies and assisting with a proper presentation of the industry to the general public through the press.

The Society numbers in its membership the editors of all the trade papers in the field and attempts to keep them informed of those occurrences which are in need of wide public dissemination. It cooperates with all papers in bringing to the technical public the various items of news concerning recent developments.

In the field of education, The Society is represented by the Ceramic Educational Council, which is composed of the educators in the schools of collegiate rank that have courses in ceramics. This Council has been most active in securing a proper place for the teaching of ceramics in the colleges and universities as well as carrying on an active

discussion of the proper curricula for such schools.

Also of paramount importance in the field of education is the sponsorship of Student Branches of The Society. In these meetings the student members obtain a good idea of the operation of The Society as well as valuable experience in organizing and conducting the affairs of a cooperative undertaking. The student member learns to make reports and to talk to his fellows in an easy and competent manner. In these meetings he prepares himself to present matters of much greater importance after he has entered business life.

Just as it takes leadership in the field of education, so The Society participates in international cooperation. Literature of other nations is reviewed and abstracted, but, of more importance, the avenue of discussion with interested technologists in foreign countries is kept open to members. To mention only a few, The Society is closely in touch with the Society of Glass Technology of England, the British Ceramic Society, the Institute of Vitreous Enamellers, and the Canadian Ceramic Society. Although these foreign contacts are much in the news today, they are less important than the contact which is maintained with state and industry associations in this country.

In several states there are now operating Ceramic Associations. These groups are formed to represent the interests of the ceramic manufacturers. They are usually centered at the state university or some other school which leads in ceramic work in the state. The Society has welcomed the opportunity to assist with the creation of several of these organizations and cooperates with all of them.

By the use of a Committee on Geological Surveys, contact is maintained with the Geological Surveys of each state. These are of great interest to the suppliers of raw materials, as many new developments are being turned up by these divisions of the state governments. Such a survey is appearing in this issue of *The Bulletin* (see pp. 234–45).

The Institute of Ceramic Engineers, an affiliate of The Society, was created to keep up the standards for the engineering branch of the industry. It is open to members of The Society who are graduate or practicing ceramic engineers. It carries on a program for the furtherance of the interests of the ceramic engineer in the engineering profession.

In the field of publications, The Society has also been active in compiling and distributing bibliographies. This started in 1906, when The Society was seven years old, with a Bibliography of Clay and the Ceramic Arts. The latest addition to this long list was the Enamel Bibliography published in 1944. More will come, as these listings are an essential part of the mechanism for proper study of the science. They are the reference books which save the researcher many hours of time.

Finally The Society is the forum for the presentation of the latest research information. It is the official organization where the researcher presents his findings and asks that they be recorded for the information of others who may follow. It is the place where the date of a finding is recorded if that finding is not patented.

What other organization does so much for its members? The American Ceramic Society is truly a most important part of the operating equipment of the ceramic artist, the ceramic manager, the ceramic technologist, and the ceramic engineer.

(1945)

LETTERS FROM SERVICEMEN

San Francisco, Calif.,
9 May, 1945

Dear Sirs:

I am enclosing a money order for $12.50 for a renewal of my membership to The Society. I am sorry for the delay in submitting the remittance, but the pressure of military duties is apt to make one lax in such things. Please continue to send the magazines to my home address.

I left the Ceramic Department of the Carnegie-Illinois Steel Corporation, South Works, in June, 1944, to enter the Navy. I've come a long way since then, nearly halfway around the world, and am Supply and Communication Officer of a subchaser operating in what is called a "forward area."

You have to see some of our bases to realize the magnitude of the production our American industry has accomplished. And the ceramic industry deserves a great share of the credit when you consider that it is behind all the thousands of ships, guns, quonset huts, jeeps, and other war matériel being turned out. I'll be glad to return to ceramic work—it has a great future.

Yours truly,
EDWIN R. TODD,
Ensign, U. S. Naval Reserve

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San Francisco, Calif.,
21 May, 1945

Dear Sir:

I am greatly interested in any information about ceramic education in South America—colleges or universities which offer courses in ceramic engineering.

I am a graduate of the New York State College of Ceramics and would like to do graduate work or teach ceramics in South America.

Any information or literature that you might have which would help me get the information regarding courses and admission or prospects of teaching would be greatly appreciated.

Sincerely yours,
ARTHUR L. POWELL,
Lieutenant, Army Air Forces

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Ottawa, Ontario, Canada,
16 May, 1945

Dear Ross:

Many thanks for your service screed, which continues to be interesting.

Your recent note on refresher courses is of particular interest as I really feel rusty after five years. If, and when, further details are available, I should like to have them.

Sincerely,
LEN WATTS,
Major, Royal Canadian Engineers

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LOCAL SECTION NEWS

PITTSBURGH SECTION

One of the most successful meetings ever held by the Pittsburgh Section took place May 11.

As The American Ceramic Society Meeting was cancelled, a Spring Technical Program was arranged at Mellon Institute from 2:00 to 5:00 P.M. One hundred and fifty-one persons registered, and the following papers were presented with Harold Simpson acting as Chairman:

(1) "War Veterans in the Postwar Ceramic Industry" by J. E. EAGLE, Chief, Non-Metals Section, Miscellaneous Minerals Div., WPB, Washington 25, D. C.

(2) "Microstrength of Glass" by H. E. POWELL AND F. W. PRESTON, Preston Laboratories, Box 847, Butler, Pa.

(3) "Flow Lines in a Continuous Melting Glass Furnace as Determined by Cobalt Oxide and Pictured in Color Photographs" by VERNON W. LENZ, Owens-Corning Fiberglas Corp., Newark, Ohio.

(4) "Recuperation in Direct-Fired Tunnel Kilns" by PHILIP DRESSLER, Swindell-Dressler Corp., Pittsburgh 30, Pa.

(5) "Development of Zircon as a Versatile Ceramic Material" by N. R. THIELKE AND H. W. JAMISON, Orefraction, Inc., Pittsburgh 8, Pa.

(6) "X-Ray Diffraction Data for Compounds in the $CaO–MgO–SiO_2$ System" by C. BURTON CLARK, Harbison-Walker Refractories Co., Pittsburgh 22, Pa.

The annual Ladies' Night Program was combined with the Technical Program, and at 6:30 P.M. an excellent dinner was served at the University Club to about 240 guests. Francis C. Flint acted as Toastmaster and called for short talks from a number of the persons present, which were followed by an interesting chalk talk by Charles K. Williams of the Homer Laughlin China Co., Newell, W. Va., entitled "Pictures and Pitchers." Following the entertainment, there was dancing from 9:00 P.M. until 1:00 A.M. with a good orchestra.

The following Committee was in charge of the dinner and entertainment:

ARTHUR A. WELLS, *Chairman*, Homer Laughlin China Co., Newell, W. Va.
NORBERT S. GARBISCH, Garco Products, Inc., Butler, Pa.
FRANCIS C. FLINT, Hazel-Atlas Glass Co., Washington, Pa.
W. KEITH MCAFEE, Universal Sanitary Mfg. Co., New Castle, Pa.

—HOWARD PARKHURST, *Secretary*

(*See opposite page for complete list of 1945 Committees*)

CENTRAL OHIO SECTION

Beautiful Granville Inn at Granville, Ohio, provided the setting for the second meeting of the current year for members of the Central Ohio Section. W. E. Cramer, Chairman of the Section, presided at both afternoon and evening sessions held May 23. One hundred and two members attended the evening banquet and reception held for C. Forrest Tefft and J. D. Sullivan, newly elected President and Treasurer of The American Ceramic Society.

Afternoon Session

At the afternoon technical session, a varied and interesting group of papers was presented. The subjects, chosen from the titles submitted for the Forty-Seventh Annual Program of The Society, were selected from the Materials and Equipment, Refractories, Structural Clay Products, and White Wares Divisions.

R. H. Green urged the ceramic industry to seek the help of the manufacturers of infrared equipment when confronted with drying problems. His paper, written by himself and Ira J. Barber of the Fostoria Pressed Steel Corp., Fostoria, Ohio, was entitled, "Infrared Radiation Looks at the Ceramic Industry." Mr. Green quoted from an article by R. E. Gould of the Buffalo Pottery on the use of infrared radiation in the drying processes. An illuminative series of colored slides on the installation and operation of varying types of infrared equipment was shown in connection with the talk which was concluded after an interesting question period.

J. O. Everhart of the Ohio State University Engineering Experiment Station presented his paper on "Factors Influencing Size Variations in Stiff-Mud Fire-Clay Refractories." This was a report on an investigation to determine the relative effect of variables in the production of stiff-mud fire-clay refractories on the size variation of the finished ware. The variables studied were the degree of vacuum, moisture content, cutter-wire spacing, repress-mold-box sizes, drying rate, and firing temperatures.

Dr. Everhart found that variation in firing treatment was the greatest factor influencing size variation. Normal variation in cutter-wire setting was also shown to be quite effective. When these two variables were closely controlled, 97.2% of the 9-inch straights were held to within $^1/_{32}$ inch of the average size and 100% were within $^1/_{16}$ inch.

Other variables did not seem to have any measurable effect on size distribution. Even wet setting which increased kiln marking did not increase the range of size variation. Dr. Everhart believes that if close attention is given to cutter maintenance and firing control, a uniformly sized product will result.

Philip W. Tefft of the Claycraft Co., Columbus, Ohio, presented a paper on "Increasing the Life of Brick and Tile Dies." He discussed the use of welded-steel dies for the extrusion of brick and tile. Such dies are much cheaper than the conventional machined type. Mr. Tefft illustrated his talk with a slide showing a drawing of the welded-steel die.

"Lead Replacements in Dinnerware Glazes" was discussed by John Marquis of the Engineering Experiment Station. The report was based on research sponsored by the United States Potters Association and covered the three stages of laboratory investigation, plant trials, and the final incorporation of two of the formulas in production during the current year when the supply of lead has been drastically curtailed. Glazes in which lead has been replaced with the oxides of lithium, strontium, zinc, and magnesium have two fundamental advantages over the old type of high-alkali, leadless glaze. They produce an insoluble glaze to work with in the plants and can be developed not to craze on bodies with relatively low expansion.

Movies of the making of glass and spark plugs were shown by H. O. Krehbiel of the Accurate Pyrometric Cone Co., Pataskala, Ohio. The showing of the movies concluded the afternoon program.

Evening Session

The evening address was on "Postwar Homes" and was given by Todd Tibbals of Tibbals, Crumley and Musson, Architects, Columbus, Ohio. A number of colored slides were shown to illustrate the modern trend in architecture. Mr. Tibbals recommended the use of varied and contrasting textures in building materials and expressed the opinion that building brick is one of the finest structural materials for inside as well as outside walls. He also suggested that architects would be pleased to have a ceramic window sill available which would not deteriorate because of the presence of moisture and which would have an easily cleaned surface. Mr. Tibbals emphasized that a well-designed modern house must blend into the landscape and reflect the spirit of our times rather than be a copy of the architecture of other periods.

—JOHN MARQUIS, *Secretary*

SOUTHERN CALIFORNIA SECTION

A meeting of the Southern California Section was held May 10, 1945, in Los Angeles, Calif. The program was as follows:

(1) *Proposed revision of the Section By-Laws:* The new By-Laws, as revised by the Executive Committee, were discussed by the members and adopted.

(2) *Discussion of the possibility of establishing a ceramic engineering course in a California university:* A committee was formed to survey requirements and possibilities of employment in local ceramic industries and instructed to work with the Northern California Section to the end that a suitable course be established in one of the state universities.

(3) *Southern California refractories problems:* Talks on local refractory mining, manufacturing, and control problems were presented by three of the Section members, as follows:

(*a*) "Southern California Refractory Materials, Their Geology, Winning, and Properties" by J. CLARK SUTHERLAND, Pacific Clay Products, Los Angeles 31, Calif.

(*b*) "Refractory Manufacturing Methods and Problems" by GREGORY L. ROGERS, Gladding, McBean & Co., Los Angeles 26, Calif.

(*c*) "Refractory Control and Research" by ROBERT W. ELLISON, Vitrefrax Corp., Los Angeles 11, Calif.

—W. O. BRANDT, *Secretary*

BALTIMORE-WASHINGTON SECTION

The Baltimore-Washington Section of The American Ceramic Society held a special Spring Meeting June 2 at the Lord Baltimore Hotel, Baltimore, Md.

One hundred and four members and guests were present, including Dr. Marcus Francis and Dr. Harris Heron of the British Pottery Research Association.

The afternoon session opened with words of greeting by Ross C. Purdy, General Secretary of the parent Society.

The afternoon session was high-lighted by a talk on "The Electron Microscope and Further Development in Microanalysis" by Dr. James Hillier of the R.C.A. Laboratories. This talk brought out the great possibilities of this relatively new instrument with its great magnification and resolving power in aiding the ceramist to study his problems of surface finishing and the identification of the various finely ground ceramic-mix ingredients and their interreaction products.

The remainder of the afternoon session was devoted to the following papers:

(1) "Recent Developments in Grinding Ceramic Materials in Pebble, Ball, and Tube Mills" by G. F. METZ, Hardinge Co., York, Pa.

(2) "Testing Chrome-Magnesite Brick for Resistance to Iron Oxide Bursting" by SAMUEL ZERFOSS, Department of Ceramics; AND H. M. DAVIS, Department of Metallurgy, Pennsylvania State College, State College, Pa.

(3) "Discussion of Some of the Defects in Optical Glass Caused by Working Conditions" by W. W. COFFEEN, National Bureau of Standards, Washington, D. C.

(4) "Electrostatic Spraying of Porcelain Enamels" by JAMES B. WILLIS, Pemco Corp., Baltimore, Md.

After a dinner and short business meeting, the evening session was concluded with the Edward Orton, Jr., Fellow Lecture by Dr. Clarence S. Ross, Chief, Section of Petrology, United States Geological Survey. Dr. Ross, in his lecture on the subject, "Minerals and Mineral Relationships of the Clay Minerals," explained by formulas the mineral relationships of the various clay minerals.

The following officers were elected for 1945–1946:

Chairman: J. C. RICHMOND, National Bureau of Standards, Washington 25, D. C.

Vice-Chairman: C. B. SHELLEY, General Refractories Co., Baltimore 3, Md.

Secretary-Treasurer: P. J. YAVORSKY, National Bureau of Standards, Washington 25, D. C.

Councillor: W. R. Lester, Maryland Glass Co., Baltimore 30, Md.

A committee was appointed consisting of J. B. Willis of the Pemco Corporation, *Chairman*, and A. S. Creamer of the National Bureau of Standards to work with the Section officers in arranging the programs for the coming year.

—C. B. SHELLEY, *Secretary*

PITTSBURGH SECTION COMMITTEES FOR 1945

Executive Committee

Chairman: H. E. SIMPSON, Mellon Institute, Pittsburgh 13, Pa.

Vice-Chairman: J. W. JORDAN, Mellon Institute, Pittsburgh 13, Pa.

Secretary: HOWARD M. PARKHURST, General Refractories Co., Pittsburgh 22, Pa.

Treasurer: LOUIS A. SMITH, Jones & Laughlin Steel Corp., Aliquippa, Pa.

Councillor: E. H. FRITZ, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

Program Committee

J. W. JORDAN, *Chairman*, Mellon Institute, Pittsburgh 13, Pa.

H. C. HARRISON, Central Engineering Lab. and Stds. 11-L-47, Westinghouse Electric Corp., East Pittsburgh, Pa.

JOHN F. HUNT, Orefraction, Inc., Pittsburgh 8, Pa.

Membership Committee

C. M. LAMBE, JR., *Chairman*, U. S. Gypsum Co., Pittsburgh, Pa.

L. R. BURKE, Charles Taylor Sons Co., Pittsburgh, Pa.

J. EARL FRAZIER, Frazier-Simplex, Inc., Washington, Pa.

RALSTON RUSSELL, JR., Research Labs., Westinghouse Electric Corp., East Pittsburgh, Pa.

Publicity Committee

JOHN S. NORDYKE, *Chairman*, Eagle-Picher Lead Co., Pittsburgh, Pa.

C. A. BRASHARES, Harbison-Walker Refractories Co., Pittsburgh, Pa.

F. K. CLARKE, Mellon Institute, Pittsburgh 13, Pa.

Dinner Committee

A. PAUL THOMPSON, *Chairman*, Mellon Institute, Pittsburgh 13, Pa.

C. E. LEBERKNIGHT, Kopp Glass, Inc., Pittsburgh 18, Pa.

R. G. EHMAN, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Entertainment Committee

A. A. WELLS, *Chairman*, Homer Laughlin China Co., Newell, W. Va.

W. KEITH MCAFEE, Universal Sanitary Mfg. Co., New Castle, Pa.

NORBERT S. GARBISCH, Garco Products, Inc., Butler, Pa.

F. C. FLINT, Hazel-Atlas Glass Co., Washington, Pa.

Committee on Sections and National Society

A. PAUL THOMPSON, *Chairman*, Mellon Institute, Pittsburgh 13, Pa.

E. WARD TILLOTSON, Mellon Institute, Pittsburgh 13, Pa.

A. A. WELLS, Homer Laughlin China Co., Newell, W. Va.

W. KEITH MCAFEE, Universal Sanitary Mfg. Co., New Castle, Pa.

F. C. FLINT, Hazel-Atlas Glass Co., Washington, Pa

J. S. GREGORIUS, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

E. H. FRITZ, Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

RALSTON RUSSELL, JR., Research Labs., Westinghouse Electric Corp., East Pittsburgh, Pa.

THEODORE LENCHNER, Vitro Manufacturing Co., Pittsburgh, Pa.

H. E. SIMPSON, *ex officio*, Mellon Institute, Pittsburgh 13, Pa.

CERAMIC SCHOOLS

CURRICULUM REVISED AT THE UNIVERSITY OF ILLINOIS

Recognizing the present-day educational trend and the need for reorganization and modernization, the Department of Ceramic Engineering at the University of Illinois is now presenting a new undergraduate curriculum in ceramic engineering to replace those formerly given. In this new curriculum there is opportunity for specialization for either production or research in any of the different branches of ceramic engineering. The new curriculum includes a sound training in science and engineering with a general introduction to ceramics in the sophomore year, fundamentals of ceramic engineering in the junior year, and specialization and practical applications in the senior year. Ample opportunity is offered for broadening courses

Curriculum in Ceramic Engineering (Degree, B.S. in Ceramic Engineering)

FIRST YEAR

First Semester	Hours	Second Semester	Hours
Chem. 2 or 3, Inorganic Chemistry	3 or 4	Chem. 5, Inorganic Chemistry and Qualitative Analysis	5
G.E.D. 1 or 4, Elements of Drawing	4	G.E.D. 2, Descriptive Geometry	4
Math. 10*a*, Combined Freshman Mathematics	5	Math. 10*b*, Combined Freshman Mathematics	4
Rhet. 1, Rhetoric and Composition	3	Rhet. 2, Rhetoric and Composition	3
Hygiene	2	Physical Education	1/2
Physical Education	1/2	Military Science (for men)	1
Military Science (for men)	1	Engineering Lecture	0
Engineering Lecture	0	TOTAL	17 1/2
TOTAL	18 1/2 or 19 1/2		

SECOND YEAR

Cer. E. 31, Introduction to Ceramic Engineering	3	Cer. E. 32, Ceramic Processes and Equipment	3
Chem. 23*b*, Quantitative Analysis	5	Geol. 20, General Mineralogy	3
Math. 8*a*, Differential Calculus	3	Math. 8*b*, Integral Calculus	3
Phys. 1*a*, General Physics	4	Phys. 1*b*, General Physics	4
Phys. 3*a*, Physics Laboratory	1	Phys. 3*b*, Physics Laboratory	1
Physical Education	1/2	T.A.M. 1, Analytical Mechanics (Statics)	2
Military Science	1	Physical Education	1/2
TOTAL	17 1/2	Military Science	1
		TOTAL	17 1/2

THIRD YEAR

Cer. E. 33, Ceramic Technology	5	Cer. E. 34, Ceramic Technology	5
Cer. E. 35, Principles of Drying	3	Cer. E. 36, Kilns, Furnaces, and Firing Operations	3
Chem. 40, Elementary Physical Chemistry	3	Cer. E. 37, Pyrometry	2
T.A.M. 3, Resistance of Materials	3	Phys. 16, Heat	3
T.A.M. 63, Resistance of Materials Laboratory	1	Technical Elective	2–3
Approved Elective	3	Approved Elective	3
TOTAL	18	TOTAL	18–19

FOURTH YEAR

Cer. E. 38, Drier and Furnace Design	2	Cer. E. 39, Ceramic Engineering Design	3
Cer. E. 40, Ceramic Bodies and Glazes	5	Cer. E. 41, Refractories	2
E.E. 4, D.-C. and A.-C. Circuits and Machines	2	E.E. 5, Application of Electrical Equipment	2
E.E. 64, D.-C. and A.-C. Circuits and Machines Laboratory	1	E.E. 65, Electrical Equipment Laboratory	1
Technical Elective	5	Technical Elective	5–4
Approved Elective	3	Approved Elective	3
Inspection Trip	0	TOTAL	16–15
TOTAL	18		

Technical Electives in Ceramic Engineering

Cer. E. 42, Ceramic Microscopy	3
Cer. E. 43, Cements, Limes, and Plasters	2
Cer. E. 44, Elementary Glass Technology	3
Cer. E. 45, Advanced Glass Technology	2
Cer. E. 46, Porcelain Enamels	4
Cer. E. 96, Research Methods	Varies
Cer. E. 98, Thesis	Varies

Description of Ceramic Engineering Courses

Cer. E. 31, Introduction to Ceramic Engineering: Raw materials, classification and characteristics of ceramic products, and methods of manufacture. 2 recitations and 1 laboratory. I, (3).

Cer. E. 32, Ceramic Processes and Equipment: Sources, preparation of materials, and manufacturing processes and control. 3 recitations and field trip. II, (3).

Cer. E. 33, Ceramic Technology: Physical and chemical properties and reactions of ceramic materials and mixtures. 3 recitations and 2 laboratories. I, (5). Prerequisite: Junior standing.

Cer. E. 34, Ceramic Technology: Continuation of Cer. E. 33. 3 recitations and 2 laboratories. II, (5). Prerequisite: Cer. E. 33.

Cer. E. 35, Principles of Drying: Drying, drying equipment, and construction and regulation of driers. 3 recitations. I, (3). Prerequisite: Cer. E. 33 or registration in Cer. E. 33.

Cer. E. 36, Kilns, Furnaces, and Firing Operations: The firing process, utilization of fuels, types of kilns and furnaces and their operation. 3 recitations. II, (3). Prerequisite: Cer. E. 34 or registration in Cer. E. 34.

Cer. E. 37, Pyrometry: Principles and methods used in high-temperature measurement. 1 recitation and 1 laboratory. I and II, (2). Prerequisite: Junior standing.

Cer. E. 38, Drier and Furnace Design: Design of ceramic driers, kilns, and furnaces. 2 laboratories. I, (2). Prerequisite: T.A.M. 3, Cer. E. 35 and 36.

Cer. E. 39, Ceramic Engineering Design: Design of special ceramic equipment, factory planning and layout. 3 laboratories. II, (3). Prerequisite: T.A.M. 3, Cer. E. 35, 36, and 38.

Cer. E. 40, Ceramic Bodies and Glazes: Materials, compositions, processing, properties, and tests. 3 recitations and 2 laboratories. I, (5). Prerequisite: Cer. E. 34.

Cer. E. 41, Refractories: Composition and properties of refractory materials and products, their manufacture and use. 2 recitations. II, (2). Prerequisite: Cer. E. 34 and 36.

Cer. E. 42, Ceramic Microscopy: The application of microscopic methods for the study of ceramic materials, reactions and products. 1 recitation and 2 laboratories. II, (3). Prerequisite: Geology 6.

Cer. E. 43, Cements, Limes, and Plasters: Compositions, reactions, method of manufacture, and testing. 2 recitations. I, (2). Prerequisite: Cer. E. 33 and 34.

Cer. E. 44, Elementary Glass Technology: Preparation of glasses of various compositions, measurement of properties, and methods of melting and forming used in industry. 2 recitations and 1 laboratory. II, (3). Prerequisite: Junior standing.

Cer. E. 45, Advanced Glass Technology: Constitution and physical and chemical properties of glasses. I, (2). 2 recitations. Prerequisite: Senior standing.

Cer. E. 46, Porcelain Enamels: Compositions, preparation, application, properties, and tests. 2 recitations and 2 laboratories. II, (4). Prerequisite: Registration in Cer. E. 34.

Cer. E. 96, Research Methods: Procedures and planning of investigations in ceramic research. I or II, (1–3). Prerequisite: Senior standing in ceramic engineering.

Cer. E. 98, Thesis: Research on a selected subject. I or II, (1–3). Prerequisite: Cer. E. 96 and consent of Head of the Department.

Cer. E. 99, Inspection Trip: Visit to industrial plants, I, (no credit). Prerequisite: Senior standing.

Returning Veterans

The Staff of the Department has formulated definite plans for meeting the requirements of returning veterans and other special students who wish to review a part of their technical training before accepting positions in the ceramic industry.

Since the educational backgrounds of these students will vary, their requirements will be met in the following ways.

Those students whose curricula were interrupted in the freshman, sophomore, junior, or senior years will continue with the regular undergraduate curriculum.

Graduates from the regular four-year curricula in ceramics or ceramic engineering who went immediately into service and feel that they have lost contact with the field will, in general, take a specially designed intensified graduate course and either additional graduate work toward a Master's degree or certain new undergraduate courses.

Those graduating from some other field and desiring to transfer to ceramics or ceramic engineering will take certain selected undergraduate courses, the specially designed intensified graduate course and other graduate courses leading to an advanced degree.

Special students not having a college background and desiring an accelerated program to train them for a specific place in one of the various phases of the ceramic field, such as structural clay products, enamels, glass, refractories, or whiteware, may elect a regular sequence of undergraduate courses to meet their specific requirements.

Scholarships

The returning veterans will, in most cases, receive financial aid in their educational training through the provisions made by the Federal or State Governments for returning servicemen.

For new students entering the University, a Scholarship Trust Fund has been established by contributions from certain prominent ceramic manufacturers. Ten 2-year scholarships, covering the matriculation and tuition fees, are available each year. Awards will be made by the Committee on Awards to Special Undergraduate Scholarships.

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MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(447) Lt. John G. Brady, Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada
(448) Vernon W. Lenz, Owens-Corning Fiberglas Corp., Newark, Ohio
(449) Albert J. Reed, Harbison-Walker Refractories Co. Willard, Ohio

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

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INSTITUTE OF CERAMIC ENGINEERS

Executive Committee, 1945–1946

President: T. A. KLINEFELTER, Southern Experiment Station, U. S. Bureau of Mines, Tuscaloosa, Ala.
Vice-President: C. M. DODD, Iowa State College, Ames, Iowa.
Secretary: ROBERT TWELLS, Electric Auto-Lite Co., Spark Plug Div., Fostoria, Ohio.
Past-President: M. F. BEECHER, Norton Co., Worcester, Mass.
Trustee Representative: H. M. KRANER, Bethlehem Steel Co., Bethlehem, Pa.

REPORT OF PRESIDENT M. F. BEECHER

The Institute of Ceramic Engineers has a very specific function which is quite definite and distinct from the functions of The American Ceramic Society. The Institute is made up of men with engineering training and experience which not only qualifies them, but in fact makes them responsible, for contributing to the general welfare of the engineering profession. The importance of an activity of this character is continuously increasing because of the changes taking place in political thinking and practices as reflected, for example, in the regulations with respect to employment relations and the increasing importance of economic as against geographic interests in legislation. Moreover, in the matter of making progress in the direction of rendering greater service to society, engineers as a group should give attention to improving the status of the profession by developing greater capacity for service, both technical and civic.

The Institute therefore provides a mechanism whereby this relatively small group of engineers can contribute its share toward this general objective. By means of this organization, the ceramic engineer can become an active part of the group which is working toward the adoption of legislation toward the registration of engineers, and subsequently their registration. They can engage in the work of raising the standards of teaching through cooperation with the Ceramic Educational Council and the Engineers' Council for Professional Development. They can also serve the group in the matter of protecting and improving its economic status.

There have been some disappointments among members of The American Ceramic Society through failure to be invited or accepted as members in the Institute. This, it appears, arises largely out of our failure to emphasize properly the objectives and purposes previously defined. The fault is ours. In order that ceramic engineers may engage in this common responsibility of engineers, it is necessary that they be organized on a basis of qualifications which (1) establishes them on the same professional basis as engineers in other groups and includes all those who should share in this effort and (2) excludes those who do not or could not be expected to have this interest in the welfare of engineers and should not be called upon to support through their work and dues an effort which will result in no special benefit to them or their group. It is as unfair to call upon those members of The Society to support this work who are not engineers and do not have a common interest with engineers generally as it is for the engineer who can qualify to neglect supporting it.

Our relationship with The American Ceramic Society is a sensible one and can be made a very effective instrument of advantage to both The Society and the Institute. We are set up on a basis quite different from that of other engineering groups. It is not our object to assemble and disseminate new engineering knowledge in the field of ceramics. That function is carried out quite satisfactorily by The American Ceramic Society. But the Institute recognizes the responsibility of ceramic engineers to contribute to that activity, and therefore a continuing requirement of membership in the Institute is the maintenance of membership in The American Ceramic Society and, of course, the implied requirement of contribution to The Society's activities. Such an arrangement obviates duplication and results in a better and more extensive fund of ceramic information assembled in a single place. Economy results, for there is a lesser cost of such service to all concerned. The advantage to the Institute is essentially that its whole effort can be devoted to its specific objective

The importance of economy in this matter should receive more than just passing mention. The young ceramic engineer just out of school needs ready and continuous access to the current ceramic literature; he needs also a path along which he can progress toward full recognition as a member of the engineering profession. The present arrangement between The Society and the Institute allows him to do this at a cost in dues comparable with that required of young men in other branches of engineering. We in the Institute profess, and I think honestly, a serious interest in the welfare of the young engineer, and we know out of our own experiences that the item of technical society dues is not one of little concern for the young man.

We have completed only seven years in this relationship, a very short time, to be sure, but we have made such progress in it that the advantages seem to be well proved and justify the expectation that a continually stronger Society and Institute will develop from it.

Membership in the Institute of Ceramic Engineers is not an award or distinction which is conferred upon members of The American Ceramic Society for some meritorious service. It is instead the assumption of a responsibility to help carry on an activity specifically for the benefit of engineers. It grows out of a willingness on the part of the individual to contribute his share toward the improvement of the status of professional engineers. The responsibility is first of all to see that ceramic engineers supply an ever-increasing quality of technical service on an ever-rising plane of ethical behavior. This, in short, constitutes "promotion of professional status."

The Institute, through its relatively few years of existence, has made remarkably good progress in the directions indicated. There is a great deal of urgent work yet to be done even in the matter of preparing for better carrying on the work that is outlined. In the statement recently published in *The Bulletin* on the subject of "The Institute—What It Is and What It Does" (February, 1945, *Bulletin*, pp. 66–69), a good outline of the accomplishments to date and the plan of work is presented. During the past year, the Committee on Professional Status and Development has found it necessary to give some attention to the matter of economic status. It is probable that this subject will loom much larger in the years immediately to come. This Committee, together with the Committees on Engineers' Council for Professional Development and State Boards of Engineering Examiners, has continued and extended its contacts with other engineering groups, an activity very necessary in the interest of obtaining a place and opportunity for making our contribution to the general welfare of engineers. The recommendations made in these Committees' reports are sound and forward-looking and should be acted upon constructively by the new administration.

Another subject which should have our attention is that of extending help and encouragement to the young engineering graduate. The object is to bring him into the way of recognizing his professional status and encouraging him in self-development, not only in the matter of his technical talents, but also in the direction of civic interest and responsibility. The future Institute will be made up of the young graduates of today. If that future Institute is to attain a higher professional status, the young graduate must be encouraged in this self-development now. Some features of a program for accomplishing this have been under discussion, and it is hoped and expected that a good

working plan can be developed. Although this activity comes fully within the scope of our Committee on Professional Status and Development, that Committee has already so many important responsibilities that it may well be that either a new committee to handle this specific activity should be provided or perhaps a responsible and adequately manned subcommittee be arranged. This matter should be reduced to something more definite before offered for discussion.

The membership status at the close of this year is disappointing, and for this situation the president takes full responsibility. There are, as of today, but 377 members in all grades. The losses during the year were 30 by resignation and 20 cut off for nonpayment of dues, whereas the accessions numbered only 25. One reason for this is that the Institute, through its president, has not "preached the gospel" sufficiently during the past year, the gospel of the Institute objectives and the engineer's responsibility. A second reason may be the fact that the Institute is too far submerged within the structure of The American Ceramic Society to make itself heard distinctly as a voice speaking for engineers. There is, perhaps, work still to be done in improving our internal mechanism of operation.

The Institute of Ceramic Engineers has made a very fine record of accomplishment to date and, with the same continued seriousness of purpose and willingness to work that has been disclosed by the members thus far, there is every reason to expect that the broad objectives will be attained.

April 6, 1945 —M. F. BEECHER, *President, 1944-1945*

NEW MEMBERS

Member Grade

FREDERICK C. HENDERSON, Royal China, Inc., Sebring, Ohio.

WILLARD E. PALMER, Taylor, Smith & Taylor, East Liverpool, Ohio.

Junior Grade

VAN DERCK FRÉCHETTE, New York State College of Ceramics, Alfred, N. Y.

PAUL E. BUCKLES, Electric Auto-Lite Co., Spark Plug Div., Fostoria, Ohio.

REPORT ON MEETING OF COUNCIL OF SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION

This meeting was held June 1 and 2, 1945, in Pittsburgh, Pa.

Owing to the cancellation of the annual meeting of S.P.E.E., the Council decided that the present officers should hold over until the next election.

Of interest to members of the Institute was the change in name of the Mineral Technology Division. The Council confirmed the action taken by the Division at the Cincinnati meeting in 1944 changing the name to the Mineral Engineering Division.

The Council went on record as favoring the following plan for the universal military training of all young men at the age of eighteen. (1) Three months of basic training. (2) At the end of this period, trainees would have at least one year of industrial training or, in the case of those entering college, the time required to obtain a degree. (3) Upon completion of the industrial or college training an additional six months in the Army or Navy, during which period the men would be trained in some specialty.

The Committee on Engineering Personnel reported that as the result of a survey of American industry there was a shortage, as of the present, of 40,000 graduate engineers. Taking into consideration the return of engineers now in the armed services, the shortage, after the war, would be between 25,000 and 30,000.

The Committee on Graduate Study recommended that but one third of a graduate program should be devoted to research and that but one language should be required. Also that degrees should be granted only after both written and oral examinations.

Owing to increased registration of women in the engineering schools, the Council recommended that women be admitted to honorary and professional engineering fraternities on the same basis as men.

It was reported that a considerable number of institutions were considering or already had adopted a uniform freshman year for all students and a number of engineering schools had announced five-year curricula or were considering doing so.

The committee drawing up the new constitution was not ready to report. When completed it will be submitted to the Council and later to the membership for approval.

—A. F. GREAVES-WALKER,
Member of Council, S.P.E.E.

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HONORS TO SOCIETY MEMBERS

H. RIES RECEIVES HONORARY DEGREE

The Honorary Degree of Doctor of Science was conferred upon Heinrich Ries by Alfred University, Alfred, N. Y., in June, 1945. Major E. Holmes, Dean of the New York State College of Ceramics of Alfred University, presented Dr. Ries for the degree with the following remarks:

MR. PRESIDENT: We have as our guest today an eminent scientist who has rendered services of outstanding distinction to the ceramic interests of America. This Institution can take justifiable pride in being the agency whereby recognition of those services is to be extended, by conferring on him an honorary degree.

He was born at Brooklyn, N. Y., in 1871. He was educated at Columbia University and the University of Berlin, Columbia conferring on him the degrees of Ph.B., A.M., and Ph.D. He joined the staff of Cornell University in 1898, rising to the position of Head of the Department of Geology in 1914 and filling that position until 1937. He retired in 1939. He was a great teacher, an inspiration to his students, and a model for his colleagues.

Teaching alone, however, could not provide an adequate outlet for his boundless energy and enthusiasm. Supplementary activities of many kinds have engaged his attention throughout his life, and they have yielded distinguished results. His geological survey work covered the larger part of the eastern half of the United States and Canada. He has been engaged for this work by the States of New York, Maryland, Alabama, Michigan, New Jersey, Texas, Virginia, Wisconsin, and Kentucky. His reports on these surveys are standard reference publications throughout the land.

He served as a delegate from Columbia University and Cornell University to the International Geological Congress in Russia, France, Mexico, Canada, and the United States, between the years 1897 and 1933. He served on the jury of awards at the Cotton States Exposition in 1895, the Pan-American Exposition in 1901, and the Louisiana Purchase Exposition in 1904.

He is a member of four Greek-letter honorary societies, a member of six scientific societies, an honorary member of six other societies, and a life member of three others, these societies being the largest and most important societies of this kind in this country. He was also one of that small group of farseeing courageous scientists, including Dr. Binns, who founded The American Ceramic Society in 1898. That Society has honored him by making him an Honorary Life Fellow.

He was elected vice-pesident of The American Ceramic Society in 1903 and was elected president in 1910. He served the Geological Society of America as its vice-president in 1926 and as its president in 1929. He has also filled high positions in the American Institute of Mining and Metallurgical Engineers and the American Foundrymen's Association. The American Foundrymen's Association awarded him the Seaman Gold Medal in 1936 for research on foundry sands.

His contributions to our ceramic literature are monumental. He is the author of more than 200 publications. Included in this list are a number of textbooks and reference books which are the final authority and the standard texts in their fields.

Buttressing these material achievements is that rare combination of human qualities that have won for him a host of loyal friends. Unselfish devotion to his profession, strict observance of professional ethics, an inspiring personality, combined with his distinguished scientific achievements, have won an everlasting place for him in the minds and hearts of the members of his profession.

Mr. President, I present for the Honorary Degree of Doctor of Science, Heinrich Ries.

Dr. Heinrich Ries

Dr. Ries has been Chairman of The Society's Committee on Geological Surveys since 1936. An extensive report compiled by Dr. Ries and his Committee appears on pp. 234–45 of this issue of *The Bulletin*.

For a partial list of Dr. Ries' publications and additional biographical data, see the December, 1938, *Bulletin*, pp. 490–91.

T. C. VAUGHAN ELECTED TO SIGMA XI

T. Carter Vaughan, a member of the research staff of the Libbey-Owens-Ford Glass Co., Toledo, Ohio, has been elected to membership in the honorary scientific society, Sigma Xi, by the Virginia Polytechnic Institute Section of that Society.

Mr. Vaughan received his Bachelor's degree in 1938 and his Master's degree in 1939 from the Virginia Polytechnic Institute, Blacksburg, Va., and was employed in Hartford, Conn., until a little more than a year ago when he joined the Libbey-Owens-Ford organization.

He has been a member of The American Ceramic Society since 1937.

M. F. BEECHER HONORED

Milton F. Beecher, director of research for the Norton Co., Worcester, Mass., was awarded an Honorary Degree of Doctor of Engineering by the Iowa State College, Ames, Iowa, June 15, 1945. On June 16, the Iowa State College Alumni Association of Chicago, the General Alumni Association, and Iowa State College also honored him by the presentation of a Merit Award at Alumni Day.

Merit Awards were inaugurated in 1932 to give special recognition to Iowa State College graduates who have made professional contributions of social value.

Mr. Beecher was commended for his work in the field of physical improvement of human surroundings and facilities through ceramics and its associated industries.

One of the early engineers to receive a bachelor of science degree in ceramics, Mr. Beecher was graduated from Iowa State College in 1910. Five years later, he was granted a professional degree of ceramic engineer by the same institution.

Mr. Beecher has been director of research for the Norton Company for many years. There he has amplified the Company's investigational and development activities, improved coordination with manufacturing groups, and exercised leadership in national ideas regarding the possibilities of ceramics in new channels of use.

He is the author of nine significant publications in the field of ceramics and is the owner, in several cases with partners, of nineteen patents.*

Mr. Beecher is a Charter Member of the Fellows of The American Ceramic Society. He has served The Society as a member of the Committee on Standards (1917–1923) and of the Committee on Publications (1933–1936) and has been Chairman of the Committee on Classification, Nomenclature, and Glossary since its inception in 1943. He also served on the Board of Trustees from 1919 to 1921. He is a member of the Founders' group of the Institute of Ceramic Engineers and was president of this organization from April, 1944, to April, 1945 (see p. 272, this issue). He is also a member of Tau Beta Pi and Phi Kappa Phi. He recently was honored by election to Sigma Xi by the Worcester Polytechnic Institute, Worcester, Mass.

Milton F. Beecher

* Mr. Beecher's publications and patents, along with a more complete biographical sketch, appear in the November, 1943, *Bulletin*, p. 378.

N. W. TAYLOR ASSUMES NEW DUTIES

Nelson W. Taylor has assumed the duties of technical assistant to the director of research of the Minnesota Mining & Mfg. Co., St. Paul, Minn.

Dr. Taylor still retains his position as head of the Ceramics Section, which he has held since becoming associated with the Company in November, 1943.

SIMPLIFIED PRACTICE RECOMMENDATION

Limitation Order L-316 reduced the number of items for clay sewer pipe and fittings from between 1500 and 1600 to between 300 and 375. In anticipation of the repeal of this order at the end of the war, the Industry Committee has asked the Division of Simplified Practice of the National Bureau of Standards to develop a recommendation to hold the number of items near the wartime level.

The proposed recommendation is being circulated to interested manufacturers. Copies may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

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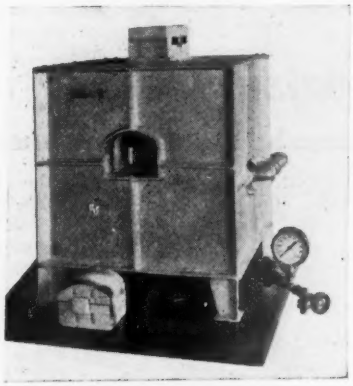
Write for Bulletin F-2



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Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
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June 21, 1944	2125	366	3	576	220	3290
December 21, 1944	2317	402	2	661	220	3602
January 21, 1945	2368	404	3	670	220	3665
February 21, 1945	2409	408	2	688	220	3727
March 21, 1945	2103	391	3	647	220	3364
April 21, 1945	2238	400	3	598	220	3459
May 21, 1945	2298	405	1	616	220	3540
June 21, 1945	2355	411	1	620	220	3607
12-month % increase	10.8	12.3		7.6		9.6

NEW MEMBERS IN JUNE

Corporation

BEAUMONT COMPANY, A. B. Beaumont (voter), Morgantown, W. Va.

COMPANHIA PAULISTA DE MINERAÇÃO, Eduardo C. Simonsen (voter), Caixa Postal 3008, São Paulo, Brazil.

ERSKINE GLASS & MFG. CO., W. S. Erskine (voter), Wellsburg, W. Va.

PIERCE GLASS CO., H. C. Herger (voter), Port Allegany, Pa.

Personal

BASTRESS, ALFRED W., Glass Science, Inc., State College, Pa.

BEAUMONT, A. B., 249 Dormont St., Morgantown, W. Va.; Beaumont Co.

*BHALLA, AMRIT K., Lahore Enamelling & Stamping Co., Putlighar, Jullundur City, Punjab, India.

BLOORE, ROBERT, Swinnerton, Ltd., Stoke-on-Trent, England.

BRADY, LT. JOHN G., Lewvan, Saskatchewan, Canada; Royal Canadian Engineers.

BREWER, CLARENCE T., 733 N. Waller Ave., Chicago 44, Ill.; Webster-Chicago Corp.

BUTLER, LOUIS A., Fourth and Canal Sts., Zanesville, Ohio.

CRAIG, JAMES E., 1055 Allison Ave., Washington, Pa.; A. W. Schmid.

DEAN, HOMER, 9 Forest Court, Knoxville, Tenn.

DE BECK, HUBERT O., Custer Non-Metallics, Custer, S. Dak.; consulting geological engineer and manager.

DILAURA, ENS. FRANCIS J., Bainbridge, Md.

ELY, WILLIAM G., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa.; manufacturing engineer.

ESSELSTYN, WILLARD A., 1214 Investment Bldg., Pittsburgh, Pa.; A. W. Schmid.

FULMER, RAYMOND C., 332 Center St., St. Marys, Pa.; research engineer, Speer Resistor Corp.

GRANT, FREDERIC J., 2901 Los Feliz Blvd., Los Angeles 26, Calif.; vice-president, Gladding, McBean & Co.

*GROGLODE, SAMUEL S., St. Clair Ave., East Liverpool, Ohio; Vitrefrax Sales Co.

HENRICKS, JOHN A., 13474 Edgewater Dr., Lakewood 7, Ohio; research chemist.

HEWITT, ARTHUR E., Spode Works, W. T. Copeland & Sons, Ltd., Stoke-on-Trent, England.

HUCKESTEIN, NICHOLAS W., 2018 Drum St., Pittsburgh 14, Pa.; Furnace Engineers, Inc.

*INGERSOLL, HARRY, 2600 West 154th St., Gardena, Calif.; Pemco Corp.

KING, JAMES S., Box 56, Negley, Ohio; West Darlington Clay Co.

KLEIMAN, MARTIN M. W., 270 Selkirk Ave., Winnipeg, Manitoba, Canada; Red Devil Heating & Mfg. Co.

KOBLER, CARL, Porcelier Mfg. Co., South Greensburg, Pa.; foreman of clay departments.

LAWSON, ROBERT W., Box 275, Erwin, Tenn.; president, Consolidated Feldspar Corp.

LIBISCH, HELEN M., 102 W. Pulteney St., Corning, N. Y.; Corning Glass Works.

LOVE, MERLE B., R. D. 2, Box 136, Greensburg, Pa.; clay shop supervisor.

MALLICK, EDWARD L., 203 West 2nd Ave., Derry, Pa.

MARKERT, FRED S., 21341 Aberdeen Rd., Rocky River 16, Ohio; vice-president, Ferro Enamel Corp.

PATE, DOROTHY R., Box 467, Norris, Tenn.; ceramic chemist, U. S. Bureau of Mines.

PATRIARCA, ARMANDO S. E., Alvarado 1146, Buenos Aires, Argentina; assistant superintendent, A. P. Green Argentina, S. A.

PECK, RICHARD M., Box 133, Alfred, N. Y.; research fellow, Briggs Clarifier Co.

POTTER, JOHN F., Bell Telephone Labs., Murray Hill, N. J.

REIMERT, R. C., Paper Makers Importing Co., Inc., 641 N. 13th St., Easton, Pa. (membership formerly in name of E. H. Smith).

*RUSSELL, WILLIAM H., Johns Hopkins Hospital, Baltimore 5, Md.

SIMONIS, P., Société Belge de Céramique, 2 Rue de la Régence, Brussels, Belgium; administrateur-délégué.

SIMPSON, THOMAS, Simpson's (Potters), Ltd., Stoke-on-Trent, England.

SPARKS, JAMES C., 2212 Carter Ave., Nashville, Tenn.; W. G. Bush & Co.

TESI, A. FRANK, 3129 Breckenridge St., Pittsburgh, Pa.; Mellon Institute and Garco Products, Inc.

THORNTON, JOSEPH W., 540 Lee St., Des Plaines, Ill.; Ingersoll Steel & Disc Co.

THORSON, MARION S., 989 Willow Rd., Winnetka, Ill.; Pure Oil Co.

TRINE, ROBERT, 1685 Blake Ave., Los Angeles 31, Calif.; pottery artware manufacture and ceramic instruction classes.

UPHAM, BERNARD G., Box 233, Lawyers Rd., Vienna, Va.

WESSELS, VINCENT E., 9403 Riverview Dr., St. Louis 15, Mo.; chemical engineer, Missouri Portland Cement Co.

WYCHE, ERNEST H., Titanium Alloy Mfg. Co., Niagara Falls, N. Y.; research engineer.

YOUNG, JOHN C., 7126 Middleton St., Huntington Park, Calif.; Hayward Optical Glass Co.

Student

New York State College of Ceramics: DOMINICK LAURIE.
University of Illinois: MARVIN PESSES.
University of North Carolina: C. ROGERS WESTLAKE.
University of Texas: SPENCER R. MILLIKEN.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

CORPORATION: V. H. Remington 1, R. R. Shively 2, Office 1.

PERSONAL: G. J. Cahoon 1, R. M. Campbell 1, Jack Day 1, H. B. DuBois 1, T. H. Elmer 1, J. R. Fisher 1, C. A. Freeman 1, J. S. Geiger 1, A. F. Greaves-Walker 1, J. S. Gregorius 1, J. E. Hansen 1, J. S. Herbert 1, J. W. Jordan 1, Theodore Lenchner 1, F. E. Lobaugh 1, E. L. Maxson 1, J. F. McMahon 1, H. M. Parkhurst 1, V. H. Remington 1, J. C. Richmond 1, Ralston Russell, Jr. 3, A. W. Schmid 2, S. R. Scholes 1, Sidney Speil 1, G. H. Spencer-Strong 1, S. M. Swain 1, J. P. Thorley 1, A. A. Wells 1, W. A. Weyl 1, W. S. Williams 1, W. G. Worcester 1, Office 11.

STUDENT: F. K. Pence 1, R. L. Stone 1, W. J. Sutton 1, H. R. Swift 1.

GRAND TOTAL: 53

ROSTER CHANGES IN JUNE†

BAKER, DONALD R., Box 134, East Canton, Ohio (Carrollton, Ohio)

BUTLER, JAMES F., 6129 Lincoln Ave., Pennsauken Township, N. J. (Camden, N. J.)

CRESS, WILLIAM C., Carolina Ceramics, Inc., Box 1257, Columbia, S. C. (Chicago, Ill.)

DIETRICH, WALDEMAR F., Box 397, Capitola, Calif. (Claremont, Calif.)

DIXON, FRED W., JR., 321 N. Central Ave., Chicago 44, Ill. (Cleveland, Ohio)

DOTY, HENRY S., American Rutile Corp., 120 Broadway, New York 5, N. Y. (Long Beach, Long Island, N. Y.)

FLANNIGAN, ALICE M., 443 Richmond Ave., Buffalo, N. Y. (Alfred, N. Y.)

GINGOLD, JACOB, 108 E. Scribner Ave., DuBois, Pa. (Keasbey, N. J.)

ILES, RAMON R., Deansboro, N. Y. (Easthampton, Mass.)

KERR, CHARLES H., 340 Main St., Brookville, Pa. (Bradenton Beach, Fla.)

LAWTON, A. V., 367 Harden St., Antioch, Ill. (Chester, W. Va.)

† Address in parentheses is former address.

LENNON, JOHN W., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa. (Columbus, Ohio)
LINTZ, E. H., 3160 San Fernando Rd., Los Angeles 41, Calif. (Cambridge, Ohio)
MINK, JOHN D., 2014 S. Walnut St., Muncie, Ind. (Dunkirk, Ind.)
MORGAN, WILLARD L., 735 Millbrook Lane, Haverford, Pa. (Columbus, Ohio)
MOTTER, A. R., 317 Hargrave St., Inglewood, Calif. (Los Angeles, Calif.)
MULLADY, RUSSELL E., 459 E. High Ave., New Philadelphia, Ohio (Niagara Falls, N. Y.)
MULLER, FREDERICK W., 139 N. Duke St., Lancaster, Pa. (Millersville, Pa.)
NOVY, ANTON R., 2818 S. Wisconsin Ave., Berwyn, Ill. (Cicero, Ill.)
POLE, GORDON R., R. D. 10, White Bear Branch, St. Paul 10, Minn. (Wilson Dam, Ala.)
SMITH, KENNETH E., Escuela Nacional de Bellas Artes, Tegucigalpa, Honduras, Central America (New Orleans, La.)
SMOCK, ALDEN W., 103 E. Underwood St., Chevy Chase, Md. (Corning, N. Y.)
SPENCE, HAROLD I., Klabin Irmaos & Cía., Avenida Suburbana 5472, Meier, Rio de Janeiro, Brazil (Santa Barbara, Calif.)
WELCH, RICHARD L., Dominion Fire Brick & Clay Products, Ltd., Claybank, Saskatchewan, Canada (Georgetown, Ontario, Canada)
WURTSBAUGH, C. G., 4152 Wilkinson Ave., North Hollywood, Calif. (Huntington Park, Calif.)
WYCKOFF, WILBUR R., 262 Cleveland Ave., Hasbrouck Heights, N. J. (Laurel, Md.)
ZINSZER, WILLIAM K., R. D. 2, Box 167, Concord, Calif. (Pittsburg, Calif.)

Wanted

. . . SERVICE ADDRESSES

Listed below are ceramists in the armed forces for whom we do not have service addresses. We wish to keep these persons informed of the activities in the ceramic industry; therefore, if their addresses are known to you it will be appreciated if you will send them to The Society's offices, 2525 N. High St., Columbus 2, Ohio.

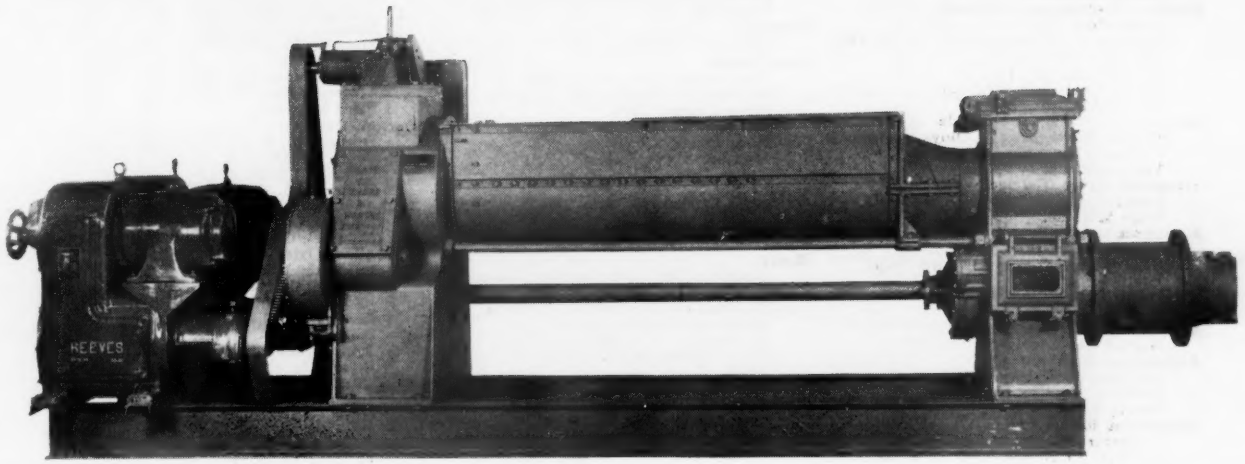
Brown, D. N.
Brown, Julian T., Jr.
Brunt, Albert E.
Bryant, C. W., Jr.
Carter, Lt. Donald R.
Christian, Raymond L., Jr.
Cooper, Maurice A.
Coughanour, L. W.
Drohan, William C.
Dye, Harold A.
Francisco, Allen C.
Gaskins, W. W.
Goldin, Joseph
Griffith, Alfred P.
Haecker, Arthur J., Jr.
Hellman, Stanley
Hubbard, Arthur E.
Humphrey, John R.
Hyde, Collin
Johnston, Archie, Jr.
Kay, William T.
Land, Lt. T. T.
Lazar, Lt. Paul
Luther, Harry E.
Macdonald, Ronald
Martin, John E.
Maupin, Addison
Maybaum, Paul S., Jr.
McCabe, Richard P.
McCann, Robert J.
Mitchell, Lt. E. T.
Morgan, Jack E.
Mueller, Capt. James I.
Nelley, John W.
Newsom, A. S.
Parry, William
Pitman, Richard D.
Potter, Paul M., Jr.
Price, James E.
Sawyer, Lt. John P., Jr.
Schlake, William E.
Schottland, A. H.
Schotts, Walter H.
Seibert, Leslie W.
Sewell, Nathan R.
Shipley, Linden E.
Smith, James N., Jr.
Stark, Ira A.
Tencza, Andrew
Truesdell, Glenn C.
Warde, John M.
Watson, William
Wheaton, L. Don

Mail addressed to the following men at their latest service address has been returned. Can you help us with a new address for them?

Barnett, Lt. Charles W. H.
Bates, Av. Cadet William S.
Crowell, Av.Cadet Robert W.
East, Lt. Walter
Eller, Pvt. Clyde B.
Epstein, Edward, Jr.
Fordham, Lt. Elmo A.
Freeman, Joseph
Fronczak, Pvt. E. T.
Hurst, Capt. T. L.
Larson, Leonard N.
Lobdell, Edward M.
McFarland, J. E.
Moffett, Capt. Robert A.
Murray, Capt. Maurice A.
Postlewaite, Donald E.
Redman, Lt. William S.
Reynolds, Cpl. Owen J.
Roe, Lt. Richard F.
Schaer, Robert W.
Siegel, Major Marvin B.
Smith, Lt. Alden J.
Tibbals, Lt. (jg) Harvey L.
Woodall, Cpl. Edward L., Jr.

As soon as correct addresses are received, we shall again place the names of these men on our Service Roster to keep them informed of activities in the ceramic industry. Please send addresses to The Society's offices, 2525 N. High St., Columbus 2, Ohio.

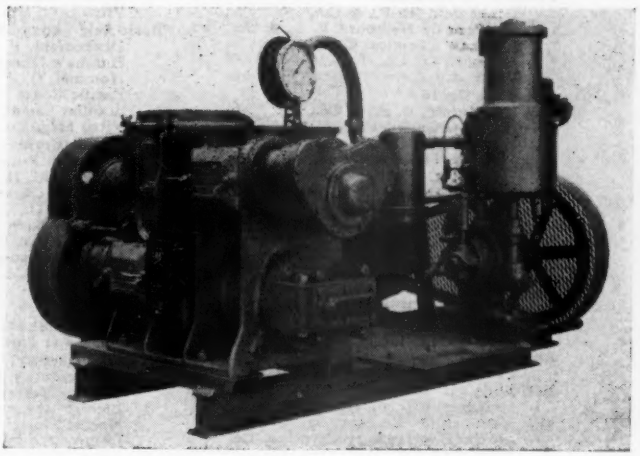
FOR "LAB" WORK OR PRODUCTION LINE . . .



There's a F-R-H Machine For the Job

F-R-H Pug Mills are available from the smallest table-top laboratory model to the larger size models for the production line. F-R-H Pug Mills are designed to do the job . . . producing the smallest size hollow tubing even with intricate coring to the largest size required for pottery ware. De-airing is available on all F-R-H Mills.

The ease with which a change-over from one material to another is made, is a pleasing feature of F-R-H Mills. Then, too, F-R-H Mills are built for long years of service, with application of ball and roller bearings in all vital moving parts of the drive and auger shafts.



If you have a mixing or extrusion problem, feel at liberty to ask for information. We'll be glad to work with you . . .

FRH

CERAMIC MACHINERY

PLYMOUTH Industrial Locomotives
SILVER KING Industrial Tractors

THE FATE-ROOT-HEATH COMPANY • PLYMOUTH, OHIO

Abrasives
Bausch & Lomb Optical Co.
Carborundum Co. (*Carborundum and Alosite*)
Electro Refractories & Alloys Corp.
Hommel, O., Co., Inc.
Norton Co. (*Alundum-Crystolon*)

Acid-proof Mortars
Corhart Refractories Co.

Air Conditioning Systems
Frazier-Simplex, Inc.

Alozite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Vitro Mfg. Co.

Alumina (Fused) Brick and Tile
Electro Refractories & Alloys Corp.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.

Aluminum Oxide (Calcine)
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Aluminum Oxide (Fused)
Carborundum Co.
Electro Refractories & Alloys Corp.
Foote Mineral Co.
Norton Co.
Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bicarbonate
Du Pont de Nemours, E. I., & Co., Inc.
Hommel, O., Co., Inc.
Solvay Sales Corp.

Ammonium Bifluoride
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Innis, Speiden & Co.
Vitro Mfg. Co.

Ammonium Carbonate
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Antimony Oxide
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Vitro Mfg. Co.

Antimony Sulphide
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Arches (Interlocking, Suspended, and Circular)
Frazier-Simplex, Inc.

Arsenic
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Automatic Brick Car Loaders
Lancaster Iron Works, Inc.

Ball Mills
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.
McDanel Refractory Porcelain Co.
Vitro Mfg. Co.

Ball Mills (Laboratory Type)
Drakenfeld, B. F., & Co., Inc.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Barium Carbonate
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Barytes
Clinchfield Sand & Feldspar Corp.
Harshaw Chemical Co.

Basic Oxides
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.

Batch Systems & Chargers
Frazier-Simplex, Inc.

Batts
Carborundum Co. ("*Carbofrax Alozite*")
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)
Remmey, Richard C., Son Co.

Bentonite
Great Lakes Foundry Sand Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Beryl
Foote Mineral Co.

Bichromate of Soda
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.

Blowers
Robinson Ventilating Co.

Body Stains
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.

Bone Ash
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Borax
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Innis, Speiden & Co.
Pacific Coast Borax Co.
Pemco Corp.
Stauffer Chemical Co.
Vitro Mfg. Co.

Borax Glass
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Boric Acid (Anhydrous)
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Corp.
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Innis, Speiden & Co.
Pacific Coast Borax Co.
Stauffer Chemical Co.
Vitro Mfg. Co.

Boron Carbide
Norton Co.

Brick Machines (also Barrows, Molds)
Lancaster Iron Works, Inc.

Brick (Refractory)
Carborundum Co. ("*Carbofrax Alozite*")
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.

Cadmium Oxide
Drakenfeld, B. F., & Co., Inc.

Cadmium Sulphide
Drakenfeld, B. F., & Co., Inc.
Du Pont, de Nemours and Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Carbofrax (Refractory Products)
Carborundum Co.

Carbonates (Barium, Lead)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Castings
Lancaster Iron Works, Inc.

Caustic Potash
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Solvay Sales Corp.

Caustic Soda
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.
Stauffer Chemical Co.
Vitro Mfg. Co.

Cements
Bausch & Lomb Optical Co.
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Co.
Norton Co.
Pennsylvania Salt Mfg. Co.
Remmey, Richard C., Son Co.

Ceramic Chemicals
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pemco Corp.
Pennsylvania Salt Mfg. Co.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Cerium Oxide
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Chromite (Natural Chromate of Iron)
Foote Mineral Co.
Hommel, O., Co., Inc.

Chromium Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Clay (Ball)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Potters Supply Co.
Spinks, H. C., Clay Co.
Vitro Mfg. Co.

Clay (China)
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

Clay—Cleaners, Feeders
Lancaster Iron Works, Inc.

Clay (Electrical Porcelain)
Hammill & Gillespie, Inc.
Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Enamel)
Ferro Enamel Corp.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Kentucky Clay Mining Corp.
Maxson, Elwyn L.
Metal & Thermit Corp.
Pemco Corp.
Spinks, H. C., Clay Co.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Clay (Fire)
Great Lakes Foundry Sand Co.
Maxson, Elwyn L.
Potters Supply Co.

Clay (Micronized)
Pemco Corp.

Clay Miners
Great Lakes Foundry Sand Co.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Modeling)
Potters Supply Co.

Clay (Potters)
Hammill & Gillespie, Inc.
Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay (Process Equipment)
Lancaster Iron Works, Inc.

Clay (Sagger)
Georgia Kaolin Co.
Great Lakes Foundry Sand Co.
Hommel, O., Co., Inc.
Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Clay-Slip (Albany)
Hammill & Gillespie, Inc.
Hommel O., Co., Inc.
Maxson, Elwyn L.

Clay (Wad)
Kentucky Clay Mining Co.
Spinks, H. C., Clay Co.

Clay (Wall Tile)
Hammill & Gillespie, Inc.

Kentucky Clay Mining Co.
Maxson, Elwyn L.
Spinks, H. C., Clay Co.

Cleaners
Harshaw Chemical Co.
Pemco Corp.
Pennsylvania Salt Mfg. Co.
Solvay Sales Corp.

Clocks (Gauge Board)
Hommel, O., Co., Inc.

CO_2 Recorders
Leeds & Northrup Co.

Cobalt, Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.

Cobalt Sulphate
Drakenfeld, B. F., & Co., Inc.
Du Pont, de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Colors
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

Combustion Control
Leeds & Northrup Co.

Combustion Meters (CO_2 Recorders)
Leeds & Northrup Co.

Cone Plaques
Industrial Ceramic Products, Inc.

Cones
Edward Orton, Jr., Ceramic Foundation
Maxson, Elwyn L.

Controllers—Automatic Tank Pressure
Leeds & Northrup Co.

Conveying Equipment
Frazier-Simplex, Inc.
Lancaster Iron Works, Inc.

Copper Oxide
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Cornwall Stone (Imported)
Drakenfeld, B. F., & Co., Inc.
Hammill & Gillespie, Inc.
Hommel, O., Co., Inc.
Maxson, Elwyn L.

Corundum Refractories
Corhart Refractories Co.

Crucibles (Filter, Melting, Ignition)
Norton Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Cryolite (see Kryolith)
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Harshaw Chemical Co.
Pennsylvania Salt Mfg. Co.
Vitro Mfg. Co.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Frazier-Simplex, Inc.

Cutters (Bar)
Industrial Ceramic Products, Inc.

Decalcomania
Commercial Decal, Inc.

Decorating Supplies
Commercial Decal, Inc.
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electro chemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Disintegrators
Lancaster Iron Works, Inc.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Dryers (Waste Heat, Continuous and Batch Type)
Harrop Ceramic Service Co.

Drying Machinery
Frazier-Simplex, Inc.
Lancaster Works, Inc

Electrocast Refractories
Corhart Refractories Co.

Enameling Equipment (Complete)
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ferro Enamel Corp.
Hommel, O., Co., Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Maxson, Elwyn L.
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Metal & Thermit Corp.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Enamels
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

Enamel Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Enamels (Porcelain)
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Engineering Service
Ferro Enamel Corp.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.

Epsom Salts
Innis, Speiden & Co.

Equipment (Porcelain Enameling)
Ferro Enamel Corp.
Hommel, O., Co., Inc.

Fans
Robinson Ventilating Co.

Feldspar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Solvay Sales Corp.
Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co.
Remmey, Richard C., Son Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.

Flint
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.

Flint Pebbles
Clinchfield Sand & Feldspar Corp.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.

Flint (Soft decomposed Cararra)
Innis, Speiden & Co.

Floating Construction for Tunnel Kiln Cars
Electro Refractories and Alloys Corp.

Floors (Non-Slip)
Norton Co.

Fluorspar
Harshaw Chemical Co.
Hommel, O., Co., Inc.

French Flint
Maxson, Elwyn L.

Frit
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co., Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Fuel Oil Systems and Control Stokers
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.

Furnaces
Carborundum Co. (*Carboradiant*)
Ferro Enamel Corp.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Furnaces (Laboratory)
Remmey, Richard C., Son Co.

Furnaces, Enameling
Ferro Enamel Corp.
Swindell-Dressler Corp.

Gauges, Draft (Recording, Indicating)
Leeds & Northrup Co.

Gauges, Pressure
Leeds & Northrup Co.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment (Batch Mixer)
Lancaster Iron Works, Inc.

Glass Furnace Refractories
Corhart Refractories Co.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Vitro Mfg. Co.

Glazes and Enamels
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Titanium Alloy & Mfg. Co.
Vitro Mfg. Co.

Glaze Spar
Clinchfield Sand & Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.

Goggles
Bausch & Lomb Optical Co.
Hommel, O., Co., Inc.

Gold
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Vitro Mfg. Co.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Gums: *Arabic*—Amber Sorts, Powdered Grained
Ghatti—Powdered, Granular, Crude
Locust Bean—Powdered
Tragacanth—Ribbon—Flake—Powdered
Innis, Speiden & Co.

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)
Remmey, Richard C., Son Co.

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.
Remmey, Richard C., Son Co.

High Temperature Mortars
Corhart Refractories Co.
Hoists, Portable Hand
Clipper Mfg. Co.
Hydrofluoric Acid
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Ilmenite
Foote Mineral Co.
Orefraction, Inc.
Iron (Enameling)
American Rolling Mill Co.
Iron Oxide
Drakenfeld, B. F., & Co., Inc.
Du Pont de Nemours, E. I., & Co., Inc.
Foote Mineral Co.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Pemco Corp.
Vitro Mfg. Co.
Kaolin
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
Hommel, O., Co., Inc.
Maxson, Elwyn L.
Vitro Mfg. Co.
Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.—Ceramic Supply Div.
Maxson, Elwyn L.
Remmey, Richard C., Son Co.
Kilns, China (Decorating)
Drakenfeld, B. F., & Co., Inc.
Ferro Enamel Corp.—Allied Engineering Div.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
Hommel, O., Co., Inc.
Swindell-Dressler Corp.
Kilns (Electric, Circular, Tunnel)
Ferro Enamel Corp.—Allied Engineering Div.
Harrop Ceramic Service Co.
Maxson, Elwyn L.
Swindell-Dressler Corp.
Kilns (Laboratory)
Remmey, Richard C., Son Co.
Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.
Laboratory Ware
Norton Co.
Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.
Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.
Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.
Lehr Loaders
Frazier-Simplex, Inc.
Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Maxson, Elwyn L.
Norton Co.
Remmey, Richard C., Son Co.
Vitro Mfg. Co.
Lithium Carbonate
Drakenfeld, B. F., & Co., Inc.
Foote Mineral Co.
Hommel, O., Co., Inc.
Metalloy Corp.
Lithium Flouride
Metalloy Corp.
Lithium Minerals
Foote Mineral Co.
Metalloy Corp.
Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.
Magnesia (Sintered, Calcined)
Drakenfeld, B. F., & Co., Inc.
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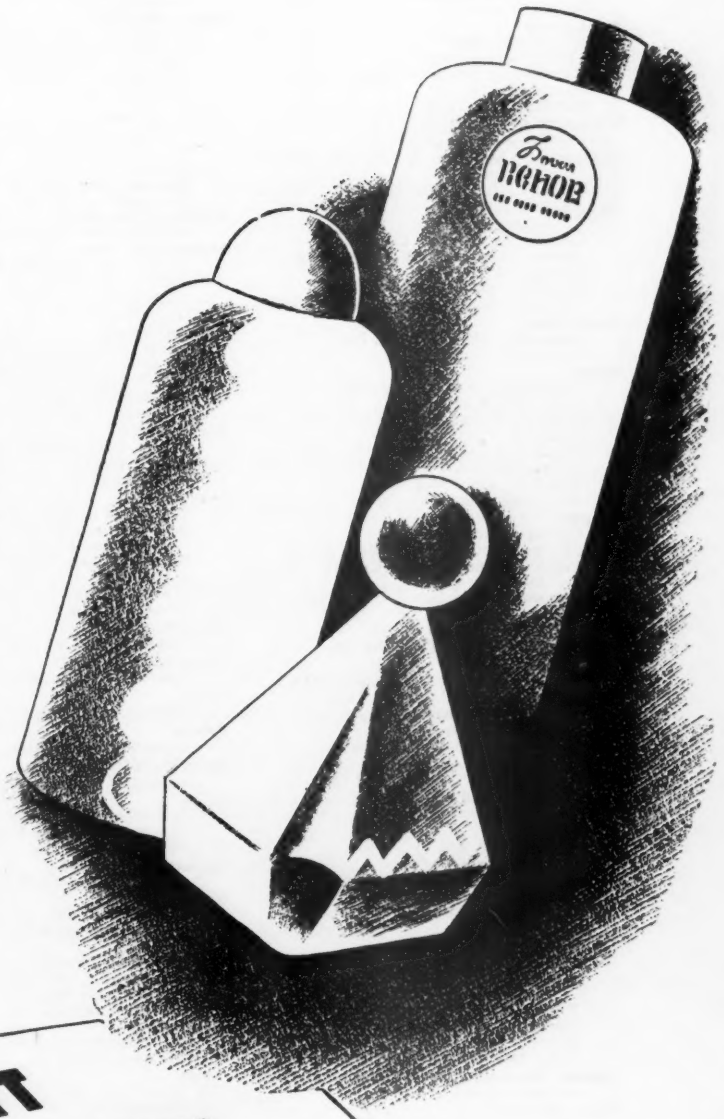

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Just behind the battlefront, a telephone system lay dead. The retreating enemy, hoping to return, had not blown it up, but had taken with them its vacuum tubes. To put it back to work, the General ordered 1000 new tubes — spot delivery.

A sample tube was flown back to the United States and brought to Bell Telephone Laboratories. It was of German design, different from any American tube in both dimensions and characteristics. Could it be duplicated soon? The job looked feasible. Within three days, try-out models were on their way to Europe. Three weeks later, Western Electric Company had made and delivered every tube. They were plugged in; vital communications sprang to life.

Vacuum tubes are an old story for Bell Laboratories scientists. Back in 1912 they made the first effective high vacuum tube. Three years later, they demonstrated the practical possibilities of tubes by making the first radio talk across the Atlantic, pointing the way to radio broadcasting. Since then, they have developed and utilized the vacuum tube wherever it promises better telephone communication — there are more than a million in your Bell Telephone System.

Today, Bell Telephone Laboratories is solving many of the toughest tube problems faced by the Armed Forces. When the war is over, it goes back to its regular job—keeping American telephone service the best in the world.

• This electrical replica of a heater-type pentode was made for use in German telephone repeaters.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war, and for continued improvements and economies in telephone service.

IT'S *Tough* GETTING AROUND TODAY

"Bumping" has become a common term. "Manpower Shortage" is another. Between the two we can't visit you as much as we'd like to. However your production problems and clay requirements are as important to us as ever.

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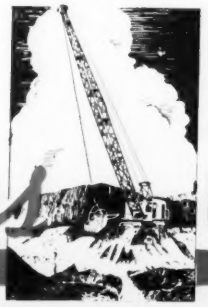

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